metal

the news digest magazine

Volume XXIX-No. 6 June, 1956

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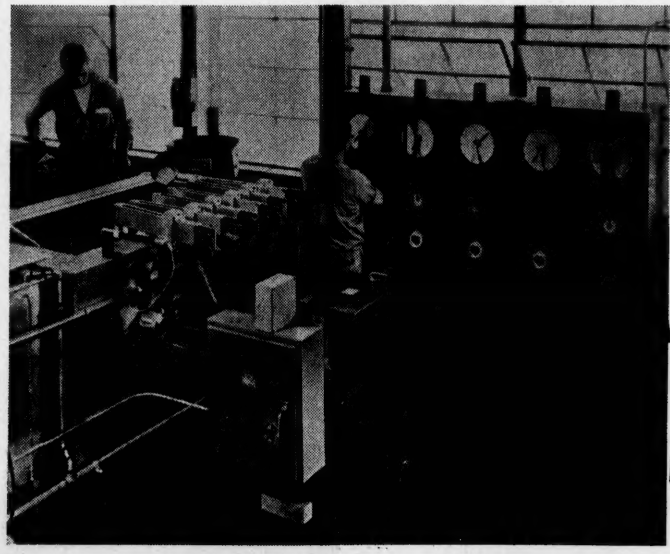

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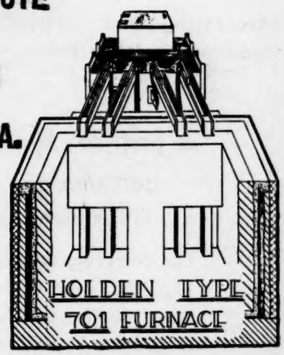

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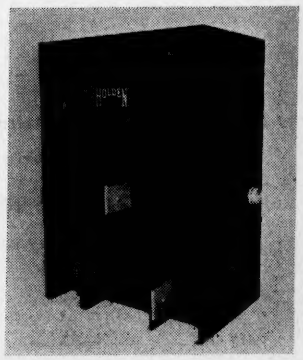

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THREE F.O.B. POINTS—LOS ANGELES, DETROIT and NEW HAVEN

Metals Review

VOLUME XXIX, 6 June, 1956

THE NEWS DIGEST MAGAZINE

Published monthly by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio: A. O. Schaefer, President; D. S. Clark, Vice-President; C. H. Lorig, Treasurer; W. H. Eisenman, Secretary; Walter Crafts, K. L. Fetters, G. E. Shubrooks, H. A. Wilhelm, Trustees; George A. Roberts, Past President. Subscriptions $5.00 per year ($6.00 foreign). Single copies $1.00. Entered as Second Class Matter, July 26, 1930 at the Post Office at Cleveland, Ohio, under the Act of March 3, 1879.

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CONTENTS

IMPORTANT LECTURES

DEPARTMENTS

ASM REVIEW OF METAL LITERATURE

Proposed Constitution Changes

To the Members of A.S.M.:

This is your official notice that the proposed changes and additions to the present constitution of the American Society for Metals will be presented for your approval during the annual meeting of the Society which will be held in the Ballroom of the Hotel Statler, beginning at 9:00 a.m. on Wednesday, Oct. 10, 1956. The proposed changes and additions (shown in bold face) have been prepared by the Constitution and By-Laws Committee of the Society and approved for presentation by the Board of Trustees at the regular meeting called for this purpose at National Headquarters in Cleveland, Ohio, on Monday, Apr. 30, and Tuesday, May 1, 1956.

Signed/W. H. Eisenman, Secretary

ARTICLE I
MEMBERSHIP

PRESENT CONSTITUTION	PROPOSED CHANGES AND ADDITIONS
Classes of Members	*Classes of Members*
Section 1. Membership of the Society shall consist of: (a) Founder Members (b) Honorary Members (c) Members (d) Sustaining Members (e) Junior Members who are defined and shall possess the qualifications shown in Section 2 hereof.	Section 1. Membership of the Society shall consist of: (a) Members (b) **Student Members** (c) Sustaining Members (d) **Life Members** (e) Founder Members (f) Honorary Members (g) **Honorary Life Members** The several classes of membership, and the qualifications for admission thereto, are defined in Section 2 below.
Qualifications	*Qualifications*
Section 2. (a). A Founder Member shall be such person as the Board of Trustees shall determine has been instrumental in the founding of the Society and has rendered distinguished service to the Society.	Section 2 (a) Any person shall be eligible to be a Member who is twenty-one (21) years of age or over and who is engaged in work related to the manufacture or treatment of metals or the arts connected therewith.
(b) An Honorary Member shall be such person as the Board of Trustees has determined has made exceptional contributions to the field of metallurgy. The total number of living Honorary Members shall not at any time exceed twenty-five (25).	(b) Any person shall be eligible to be a **Student Member** who is **engaged or interested** in work related to the manufacture or treatment of metals or the arts connected therewith **and whose principal occupation is attendance as a student at an institution of learning.**
(c) Any person shall be eligible to be a Member who is twenty-one (21) years of age or over and who is engaged in work related to the manufacture or treatment of metal or the arts connected therewith.	(c) **A Sustaining Member shall be a person, firm or corporation which,** because of exceptional interest in the work of the Society, contributes the annual dues of a Sustaining Member as hereinafter set forth.
(d) Any person, firm or corporation shall be a Sustaining Member who, because of exceptional interest in the work of the Society, contributes the annual dues of a Sustaining Member as hereinafter set forth.	(d) **A Life Member shall be any Member who shall have been in good standing for thirty-five (35) consecutive years and who shall have reached the age of sixty-five (65) years or any Member who shall have been in good standing for twenty (20) consecutive years and shall have reached the age of seventy (70) years. A representative of a Sustaining Member shall be a Life Member if such representative shall have been in good standing for thirty-five (35) consecutive years and reached the age of sixty-five (65) years or shall have been in good standing for twenty (20) consecutive years and reached the age of seventy (70) years.**
(e) Any person shall be eligible to be a Junior Member who is interested in or engaged in work related to the manufacture or treatment of metals or the arts connected therewith, provided either (1) that the person is under 21 years of age, or (2) that the principal occupation of the person is attendance as a student at some institution of learning.	(e) A Founder Member shall be such person as the Board of Trustees shall determine **to have been** instrumental in the founding of the Society and **to have** rendered distinguished service to the Society.
	(f) An Honorary Member shall be such person as the Board of Trustees **shall determine to have** made exceptional contributions to the field of metallurgy. The total number of living Honorary Members shall not at any time exceed twenty-five (25).
	(g) **An Honorary Life Member shall be such person as the Board of Trustees shall choose to recognize for distinguished service to or cooperation with the Society.**

Present Constitution

Election of Members, Junior Members and Sustaining Members

Section 3. Except in the case of Founder and Honorary Members, all applications for membership shall be in writing signed by the applicant. Such application shall be presented either to the executive committee of the local chapter with which applicant desires to affiliate, or to the Secretary of the Society if the applicant does not desire to affiliate with a local chapter. The local executive committee or the Board of Trustees, as the case may be, shall pass upon such application, and if the applicant be elected by a two-thirds (2/3) vote of the local executive committee or the Board, as the case may be, the applicant shall be classified as a Member, a Junior Member or Sustaining Member and shall be notified of the election by the Secretary of the electing body. In all cases where applications are presented to the Secretary of the Society, the Secretary shall endeavor to have the applicant affiliate with a local chapter. Whenever any applications are filed with a local executive committee and action is taken thereon, all applications so filed shall be forthwith transmitted to the Secretary of the Society, together with a report of any and all action taken by the committee thereon.

Election of Founder and Honorary Members

Section 4. Founder Members and Honorary Members shall be nominated in writing by at least ten (10) members of the Society and/or individuals appointed to represent a member firm or corporation. Nominations shall be presented to an annual or special meeting of the Board of Trustees and an affirmative vote of all the members of such Board present at the meeting shall be required to elect an Honorary or Founder Member.

Change of Grade of Membership

Section 5. Any member other than an Honorary or Founder Member, who desires to change his grade of membership, shall make application in writing therefor to the executive committee of the local chapter of which he is a member, or to the Board of Trustees if he is not a member of a local chapter.

Member Affiliation With Local Chapter

Section 6. A member of any class who is not affiliated with any local chapter and desires to become a member thereof may file application therefor with the executive committee of the local chapter with which the member desires to affiliate. The application shall be passed upon by such committee in like manner as an application for new membership and by the same vote.

Change of Chapter Affiliation

Section 7. A member of any class in good standing, who desires to transfer affiliation from one local chapter to another local chapter, shall make application therefor in writing to the executive committees of both local chapters. The application shall be passed upon by such committees in like manner and by the same vote as an application for a new membership.

Proposed Changes and Additions

Election of Members, Student Members and Sustaining Members

Section 3. **Every application for membership as a Member, Student Member or Sustaining Member shall be in writing and shall be signed by the applicant.** Such application shall be presented to the executive committee of the local chapter with which the applicant desires to affiliate, or to the Secretary of the Society if the applicant does not desire to affiliate with a local chapter. The local executive committee or the Board of Trustees, as the case may be, shall pass upon such application, and if the applicant be elected by a two-thirds (2/3) vote of the local executive committee or the Board, as the case may be, the applicant shall be classified as a Member, **Student** Member or Sustaining Member and shall be notified of the election by the secretary of the electing body. **In each case where an application is presented** to the Secretary of the Society, the Secretary shall endeavor to have the applicant affiliate with a local chapter. (No further change.)

Election of Founder, Honorary and Honorary Life Members

Section 4. Founder Members, Honorary Members and Honorary Life Members shall be nominated by a special member committee appointed by the President with the consent of the Trustees. Nominations may be presented at any duly called meeting of the Board of Trustees and an affirmative vote of all members present shall be required for election.

Change of Class of Membership

Section 5. **A Member, Student Member or Sustaining Member** who desires to change his **class** of membership . . . (No further change.)

Member Affiliation With Local Chapter

Section 6. A member of any class who is not affiliated with any local chapter and desires to become a member **of a local chapter shall make application in writing therefor to** the executive committee of the local chapter with which **he** desires to affiliate. **Such** application shall be passed upon **in like manner and by the same vote as an application for membership.**

Change of Chapter Affiliation

Section 7. **A Member of any class who desires to transfer his** affiliation from one local chapter to another local chapter shall make application in writing therefor **to the Secretary of the Society. The Secretary shall submit such application to the chapter with which the Member desires to affiliate. Such application shall be passed upon** in like manner and by the same vote as an application for membership.

ARTICLE II

VOTING AND REPRESENTATION

Present Constitution: Section 1 (a). Each member described in Article I, except a Junior Member, shall be entitled to cast one vote . . .(No further change.)

Proposed Changes and Additions: Section 1 (a) Each member described in Article I, except a **Student** Member, shall be entitled to cast one vote . . . (No further change.)

ARTICLE III

LOCAL CHAPTERS

Formation of a Chapter

Present Constitution

(c) Such petition (asking for the formation of a local chapter) shall be presented to the Board of Trustees. If two-thirds (2/3) of the total membership of the Board at a regular or special meeting vote in favor of the petition, the petition shall be granted.

Proposed Changes and Additions

(c) Such petition shall be presented to the Board of Trustees **at any regular or special meeting. If the Board, by vote of not less than two-thirds (2/3) of its total membership, determines that the formation of the chapter is in the best interests of the Society, the petition shall be granted. In any case where members affiliated with an existing chapter petition for the formation of a new chapter, the Secretary of the Society shall request and shall be furnished a report from the parent chapter as to the advantages and disadvantages, if any, that would result to the Society in the event that such petition is granted, and such report shall be made available to the Board of Trustees at or prior to the time when such petition is presented to it.**

Present Constitution

(d) Upon receipt of satisfactory evidence that at least twenty-five (25) persons, firms or corporations are duly qualified as members of such local organization and of the Society, or have made due application therefor, the Secretary shall issue, under the seal of the Society, a notification to the petitioners of the formation of the local chapter. Notice of the formation of the local chapter shall also be published in the Society's TRANSACTIONS. The local chapter so formed shall forthwith effect a permanent organization, and elect officers and committees to hold office until the next annual meeting of the chapter.

Proposed Changes and Additions

(d) Upon the granting of the petition by the Board of Trustees, the Secretary of the Society shall issue, under the seal of the Society, a notification to the petitioners of the formation of the local chapter. In any case where a new chapter is formed by members of an existing chapter or existing chapters, a similar notification shall be issued to each existing chapter affected by the action. Notice of the formation of the new chapter shall further be announced in an appropriate publication of the Society.

Annual Meeting and Fiscal Year

Present Constitution

Section 2. The annual meeting of each local chapter shall be held in the month of April or May of each year. The fiscal year of each local chapter shall begin on the date of its annual meeting.

Proposed Changes and Additions

Section 2. The annual meeting of each local chapter shall be held in the month of **March,** April or May of each year. The fiscal year of each chapter shall begin on the **day next after the annual meeting or on such other day after the annual meeting, not later than June 15, as the chapter shall determine.**

Officers of a Local Chapter

Present Constitution

Section 3. The officers of a local chapter shall be elected from its membership and shall consist of a Chairman, Vice Chairman, Secretary, Treasurer, the members of an executive committee elected as such, and such other officers as may be appointed by the executive committee. The offices of Secretary and Treasurer may be combined. All the officers, except those which may be appointed by the executive committee, shall be elected at the annual meeting of the local chapter and they shall take office on the day following the close of the annual meeting of the local chapter and shall serve until the close of the next succeeding annual meeting of said local chapter and until their successors are chosen and qualified.

Proposed Changes and Additions

Section 3. The officers of a local chapter shall be elected from its membership and shall consist of a Chairman, Vice Chairman, Secretary, Treasurer, the members of an executive committee elected as such, and such other officers as may be appointed by the executive committee. The offices of Secretary and Treasurer may be combined. **All officers of a local chapter, except officers appointed by the executive committee, shall be elected at or prior to an annual meeting of the chapter, and shall take office on the day next after the annual meeting or on such other day after the annual meeting, not later than June 15, as the chapter shall determine. They shall serve until the close of the next succeeding annual meeting of the chapter and thereafter until their successors are chosen and take office** . . . (No further change).

Duties of Officers of a Local Chapter

Present Constitution

Section 4 (d). The Treasurer shall be the financial officer of the local chapter. He shall deposit all funds of the local chapter in the name of the local chapter in such bank or banks as the local executive committee shall determine. He shall disburse all moneys for the account of the chapter and shall take proper receipt for all moneys so disbursed by him. He may be required by the executive committee of the local chapter to file a suitable bond with such committee, approved by the committee and conditioned upon the Treasurer's performing his duties faithfully and accounting for all moneys of the chapter entrusted to him. He shall make an annual report to the annual meeting of the chapter and shall forward a copy of such report to the Secretary of the Society before June 1st of each year. . .(No further change.)

Proposed Changes and Additions

Section 4 (d). The Treasurer shall be the financial officer of the local chapter He shall deposit all funds of the local chapter in the name of the local chapter in such bank or banks as the local executive committee shall determine. He shall disburse all moneys for the account of the chapter and shall take proper receipt for all moneys so disbursed by him. He may be required by the executive committee of the local chapter to file a suitable bond with such committee, approved by the committee and conditioned upon the Treasurer's performing his duties faithfully and accounting for all moneys of the chapter entrusted to him. **He shall make an annual report to the chapter either at the annual meeting of the chapter or at such time as may be designated by the executive committee of the chapter, and shall forward a copy of such report to the Secretary of the Society not later than June 15 of each year. . .** (No further change.)

ARTICLE V

DUES

Present Constitution

Amount

Section 1. The annual dues shall be as follows:

Members	$10.00
Junior Members	2.50
Sustaining Members—not less than	25.00

Exemption From Dues

Section 7. Any member whose dues shall have been paid for thirty-five (35) consecutive years or whose dues shall have been paid for twenty (20) consecutive years and who shall have reached the age of seventy (70) years shall thereafter be exempt from the payment of dues. Within the meaning of this section representatives of sustaining members shall be considered as members.

Proposed Changes and Additions

Amount

Section 1. The annual dues shall be as follows:

Members	$10.00
Student Members	2.50
Sustaining Members—not less than	25.00

Any Member who becomes a Life Member shall thereafter be exempt from payment of dues, if he so requests. Founder Members, Honorary Members and Honorary Life Members shall not be required to pay dues.

Exemption From Dues

Section 7. (To be deleted)

ARTICLE XIII

Present Constitution

Recommended Practices Committee

Section 4. The Recommended Practices Committee shall, subject to the approval of the Board of Trustees, formulate and revise recommended practices in the arts or sciences connected with the manufacture or treatment of metals and may co-operate with like committees in other technical or scientific societies. Recommended practices approved by this committee shall automatically become "Tentative Recommended Practices" for one year and until approved by the members of the Board of Trustees.

Proposed Changes and Additions

Metals Handbook Committee

Section 4. The Metals Handbook Committee shall supervise publication of the Metals Handbook and may cooperate with like committees in other technical and scientific societies.

Inaugurate Student Chapter in Albuquerque

The Newly Formed Student Chapter at Albuquerque Is Shown During the Inauguration Ceremonies Held in Socorro, N. M., at the New Mexico Institute of Mining and Technology. Members shown grouped around Keith Mead, chairman of the Albuquerque Chapter (center), include, from left: Charles Stephens, William Koenen, David Sikes, Art Mackey, Robert Tippen, student chairman, and Rudy Jacobson. (Reported by B. F. Blythe)

Donald S. Clark for President

G. M. Young for Vice-President

W. H. Eisenman for Secretary

Carl E. Swartz for Trustee

G. A. Fisher, Jr., for Trustee

National Officer Nominees Announced

NOMINATIONS for new national officers of the American Society for Metals have been announced by the Nominating Committee, which met in Hershey, Pa., on May 23-24, 1956 under the chairmanship of Carl B. Post, vice-president, Carpenter Steel Co.

Donald S. Clark, professor of mechanical engineering, California Institute of Technology, currently serving as vice-president, was nominated for president, and G. M. Young, technical director, Aluminum Co. of Canada Ltd., has been selected as the nominee for vice-president.

The committee of past presidents who nominate a secretary met in New York on May 24 and nominated W. H. Eisenman for the 20th time. This committee consisted of A.S.M. President A. O. Schaefer, chairman, and the six men who most recently held office of A.S.M. president.

Two additions proposed for the Board of Trustees are Carl E. Swartz, consulting metallurgist, Hinsdale, Ill., and George A. Fisher, Jr., manager, St. Louis technical section, Research and Development Division, International Nickel Co., Inc.

In accordance with the Constitution of the American Society for Metals, additional nominations for any of these posts except secretary may be made by written communications addressed to the secretary of the Society and signed by any 50 members. If no such additional nominations are received prior to July 15, nominations shall be closed and at the annual meeting in October 1956 the secretary will cast the unanimous vote of the members for these candidates.

D. S. Clark

Donald S. Clark, nominee for president, is a graduate of California Institute of Technology where he received a B.S. degree in 1929, an M.S. degree in 1930 and a Ph.D. degree in 1934.

From 1929 to 1934 Dr. Clark was a teaching fellow of mechanical engineering at Caltech. He was appointed instructor in 1934 and became assistant professor in 1937, and also served as consulting physical metallurgist for Industrial Research Laboratories. Dr. Clark was a member of the Board of Trustees in 1939-40.

(Continued on following page)

(*Continued from p. 8*)

G. M. Young

G. M. Young, nominee for vice-president, a native of Saskatoon, Saskatchewan, was educated at the University of Saskatchewan and McGill University, graduating in 1930 with a B.S. degree in metallurgical engineering. His industrial experience has taken him from metallurgical assistant at the Aluminum Co. of Canada's Toronto plant to chief metallurgist at the company's Kingston plant and finally to technical director of the company's Montreal plant, the position he holds at the present time.

Mr. Young has served as a member of the executive committee of the Montreal Chapter since 1947, as chairman of the Montreal Chapter during 1951-52, and was a conferee to the World Metallurgical Congress. He is also the author of several papers relating to the casting and fabrication of aluminum and its alloys.

Carl E. Swartz

Carl E. Swartz, nominee for trustee, a consultant in metallurgy and materials, was born in Olney, Ill. He received a B.S. degree from University of Illinois, and M.S. and Ph.D. degrees from the University of Wisconsin. He also did special work at Rutgers, University of California and the Harvard Graduate School of Business Administration.

Carl worked as a research metallurgist with American Smelting and Refining Co., as chief metallurgist with Cleveland Graphite Bronze Co., division metallurgist, Kellex Corp., and chairman of metals research, Armour Research Foundation. He was chairman of the Cleveland Chapter in 1941-42, on the Cleveland Chapter executive committee from 1935 to 1943, on the National Nominating Committee in 1943, and has served on the Washington and Chicago Chapters Executive Committees. He is a founder member and the first chairman of the Chicago-Western Chapter.

George A. Fisher, Jr.

George A. Fisher, Jr., second nominee for trustee, is a graduate of Purdue University. He is immediate past chairman of the St. Louis Chapter, and a member of the A.S.M. Advisory Committee on Metallurgical Education. He is manager of the St. Louis technical section, Research and Development Division, for International Nickel Co., Inc.

W. H. Eisenman

W. H. Eisenman, who was nominated for secretary for the 20th time, is a founder-member of the Society, and has been its national secretary for 38 years. In that time the Society has grown from a nucleus of 200 members to an organization of 95 chapters and more than 26,000 members.

Los Angeles Honors National Officers

National Officers A. O. Schaefer, President, Donald S. Clark, Vice-President, and W. H. Eisenman, Secretary, Were Guests During the National Officers' Night Meeting Held by Los Angeles Chapter. Mr. Schaefer, director of research, Midvale-Heppenstall Co., spoke on "Manufacture and Heat Treatment of Large Forgings"; Dr. Clark presented 25-year membership certificates to three members; and Mr. Eisenman gave a progress report on the five-point program for the "A.S.M. of Tomorrow". Shown, from left: John E. Wilson, secretary; Mr. Eisenman; Mr. Schaefer; Dr. Clark; and Roy E. Paine, chairman. (Reported by R. D. MacMahon)

High-Velocity Machining Topic of Rochester Talk

Speaker: L. J. Sheehan
Jones & Lamson Machine Co.

L. J. Sheehan, chief metallurgist, Jones and Lamson Machine Co., discussed many phases of "High-Velocity Machining" at a recent meeting of the **Rochester Chapter.**

Mr. Sheehan traced the history of metal cutting from the straight carbon grades used prior to 1870 to the present-day carbides. He pointed up the necessity of a continuous research program to solve practical production applications by evaluating the various materials, their hardness and structure, tool geometry, coolants and their applications.

To accomplish this, a reliable and inexpensive means was established as a shortcut to obtain information of value on a production floor. Studies were conducted to determine the total resultant force on a tool and its three components consisting of the tangential (horsepower), feed and radial forces. The latter two, being mainly the frictional and penetrating loads, are sensitive to wear and tool geometry and useful indices of tool wear when measured while a tool is progressing in a cut. Resultant curves established that the loads continue to decrease as cutting speed is increased until 400 to 600 surface ft. is reached. From there on results indicate that the loads remain relatively constant.

With the use of slides, Mr. Sheehan gave excellent demonstrations of the phenomena occurring in cutting operations and a subsequent film showed these at both the normal speeds and in slow motion.

Conclusions achieved were that high cutting speeds have the beneficial effects of reduced tool loads resulting in improved surface finish, elimination of excessive disturbance of the surface structure of the workpiece and improved accuracy.

An example used by Mr. Sheehan showed that a pinion gear had better quality in the surface structure turned at cutting speeds of 1000 fpm. than at 210 fpm. It was shown that the lower tool loads at higher cutting speeds permit the use of the hardest grades of carbide because there is less welding and freer chip flow.

Use of the tool dynamometer and recording oscillographs, together with measurement in terms of square inches of machined surface plotted against cutting speed, have proven to be the most efficient means for reaching satisfactory conclusions with a tremendous saving in material, tools and time.

Finally, Mr. Sheehan discussed coolants and methods of applying them to the work, stating that their best results were obtained with volume at 10 to 15 lb. pressure and jets of ¼ to ½ in. diam.

On high production installations, where maximum pieces per grind of the cutting tool are of utmost importance, inbuilt directional jets are used.—**Reported by Frank J. Gehrlein for Rochester Chapter.**

As an indication of the tremendous dissemination of engineering information a compilation shows that in one year the A.S.M. collected, edited, published and distributed over *one hundred million pages* of metallurgical information.

Reports on Stresses at Indianapolis

Shown at a Meeting of Indianapolis Chapter Are, From Left: Ed Tuttle, Vice-Chairman; Wayne Glover, Chairman; and Raymond Mattson, General Electric Research Laboratories, Who Spoke on "Fatigue and Residual Stresses"

Speaker: R. L. Mattson

General Motors Research Labs.

Raymond L. Mattson, General Motors Research Laboratories, spoke before a meeting of the **Indianapolis Chapter** on "Fatigue and Residual Stresses".

Mr. Mattson stated that the purpose of his talk was to enhance the appreciation and understanding of trapped elastic stresses. He pointed out that there is a need for closer cooperation between the engineer and the metallurgist. There is a need for more work and experimentation; in this way the induced stresses caused by the various processing treatments can become known and used to greater advantage.

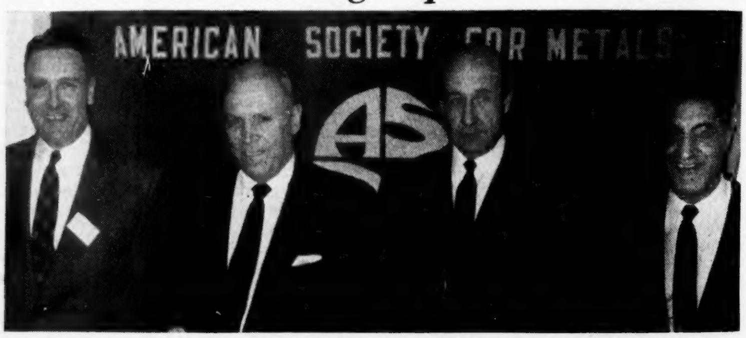
A model of a simple beam which showed how load and residual stresses are combined was demonstrated. A typical example shown was that of the straightening operation in which unfavorable residual tensile stresses are introduced.

Several case histories involving various fatigue failures were reviewed by means of a series of slides. One of the examples of fatigue failure was the failure of gear teeth induced by grinding burns. Examples of increasing fatigue life on leaf springs were discussed. It was shown that the residual stresses induced by peening were in relationship to the peening intensity and also the type of material.

A series of graphs illustrated the comparison of residual stresses at various case depths in carburized gear teeth. From other tests it was noted that the maximum compressive stresses were at the case-core boundary. Great variation exists in residual stresses near the surface and considerable variation was found in production gears with some evidence of tensile stress at the surface.

A comparison of induced compressive stresses by various heat treatments, including carburizing, carbonitriding and cyaniding, was shown. The depth of these stresses was in relationship to the depth of the case. **—Reported by Dorothy Holbrook for Indianapolis Chapter.**

Continuous Casting Topic in Worcester



Leaders at a Meeting Held by the Worcester Chapter Included, From Left: Lincoln G. Shaw, Pratt & Inman, Vice-Chairman, Who Presided; John F. Black, Manager, Continuous Casting Sales Division, Koppers Co., Inc., Who Spoke on "Continuous Casting of Steel"; G. E. Doan, Chief Metallurgist, Koppers Co., Inc.; and Nicholas P. Wakeen, Norton Co., Technical Chairman. (Photograph by C. Weston Russell for the Worcester Chapter)

Help in Resurrecting Specialized Information

Classified outlines of subject matter in specialized fields of knowledge are currently being collected by the Special Libraries Association. Such classification schemes are of tremendous help, not only to librarians but to researchers, scientists and others concerned with organizing the literature in their particular fields.

The Special Libraries Association maintains a "loan collection" of such classifications on subjects ranging from "accounting" to "wood". The collection includes both the natural and social sciences in broad categories such as chemistry, physics, and law, and in narrower subdivisions such as entomology, radiology and steels.

This collection of classification schemes is currently being brought up to date and expanded, and contributions of classifications for all fields of knowledge are being solicited. Such contributions can be donated either on a permanent basis or on loan.

The collection is housed at the School of Library Science, Western Reserve University. Plans are under way to supply microfilm or photostat copies at a nominal fee.

The work of enlarging the collection and bringing it up to date is under the direction of the Committee on Special Classifications of the Special Libraries Association. Donations of classifications or requests for further information should be addressed to: Allen Kent, Chairman, Committee on Special Classifications, SLA, School of Library Science, Western Reserve University, Cleveland 6, Ohio.

Albuquerque Members Visit Science Fair at Socorro

Gerald U. Greene and members of the A.S.M. student group at **New Mexico Institute of Mining and Technology** were hosts to the **Albuquerque Chapter** at the New Mexico Science Fair exhibits.

The Socorro campus was thronged with visitors from all parts of the State. Four hundred and nineteen students from junior and senior high schools entered 380 exhibits in the Fair competition. A rocket metering system won first place honors in the geophysics division. The rocket measured 4 ft. 8 in. in length, was gas fueled and included a launcher device. Other entries consisted of aerodynamic smoke tunnels, solar heating devices, Tesla coils, photomicrography, and a geotropism exhibit which illustrated the effect of gravitation on plants.

Following a tour of the buildings a barbecued beef dinner was served in the Student Union Cafeteria.**—Reported by B. F. Blythe for Albuquerque Chapter.**

Precipitation Hardening Steels Discussed at Chattanooga Meeting

Speaker: M. E. Carruthers
Armco Steel Corp.

The **Chattanooga Chapter** heard M. E. Carruthers, supervising metallurgist, Armco Steel Corp., speak on "Precipitation Hardening Stainless Steels". These steels have come from some ten years of research in stainless steels and have found their biggest use in aircraft.

We know the stainless steels as alloys of iron with enough chromium and nickel to be corrosion or heat resistant. The 36 or more stainless steels may be divided into three groups—ferritic, martensitic and austenitic. Only two of the standard stainless steels have exceptionally high tensile strength at room temperature and both owe their strength to martensitic structure. The precipitation hardening stainless steels are an extension of these martensitic steels in the respect that the martensite is further strengthened by the formation of a hardening precipitate. Precipitation hardening has been brought about in many types of steel by suitable alloying additions but properties have not always been useful. The first commercial precipitation hardening stainless steel was marketed in the transformed condition and consequently was not very workable. An austenitic structure was needed for workability, with subsequent heat treatment for strength.

The present 17-7 PH stainless steel answers this need. Its composition and manufacture must be carefully controlled. Received by the customer in the austenitic condition, it is cold worked, then heat treated to cause transformation and precipitation of the hardening agent. It is not definitely known what the precipitate is, but it is believed to be a nickel aluminum compound. Minimum tensile strengths of 180,000 psi. are obtained by this treatment.

The precipitation hardening steels are weldable without preheat or post heat with the inert arc method giving the best welds. They are able to retain their elasticity at high temperatures and springs can be cold formed from them, then hardened by heat treatment. Refrigeration, properly used with a new heat treating procedure, causes even higher strength with good ductility. Their strength-to-weight ratio at elevated temperatures is good.

By the use of slides, Mr. Carruthers showed examples of the use of these precipitation hardening steels and comparisons of their properties with other aircraft structural metals.—**Reported by J. H. McMinn for Chattanooga Chapter.**

⊕ has an annual budget in excess of one million dollars.

Talks on Metal Cutting at New Haven

Shown at a Meeting Held Recently by New Haven Chapter Are, From Left: Lloyd E. Raymond, Technical Chairman; M. Eugene Merchant, Assistant Director of Research, Cincinnati Milling Machine Co., Who Spoke on "Metal Cutting Research"; and Maur J. Weldon, Northeastern Steel Corp., Chairman

Speaker: M. Eugene Merchant
Cincinnati Milling Machine Co.

M. Eugene Merchant, assistant director of research, Cincinnati Milling Machine Co., presented a talk on "Metal Cutting Research" at a meeting of the **New Haven Chapter.**

The cost of machining metal enters into the cost of every manufactured article, almost everything we use or wear or eat, either in the making of the article itself or in manufacturing the machines that make it. Every year, in the United States alone, over 15 million tons of metal are whittled away into chips, at a cost of over 10 billions of dollars. The subject of metal cutting research, in relation to machining economics, is therefore important to everyone in industry.

Dr. Merchant presented an illustrated analysis of the metal cutting process showing how chips are formed and their relationship to cutting tool wear, as well as recent developments in tool wear measurements using radioactive cutting tools. With respect to machining economics, he discussed the influence of the various factors which combine to produce the machining cost per piece, and the ways in which this cost may be minimized, particularly through the use of improved machining techniques and equipment and the selection of cutting speeds and feeds by means of the new machining calculators or computors.—**Reported by K. L. Tingley for New Haven Chapter.**

Aluminum Castings Reviewed in Canada

Members of the Western Ontario Chapter Heard J. W. Bell, Assistant Works Manager, Aluminum Foundry, Aluminum Co. of Canada Ltd., Speak on "Aluminum Castings" During a Recent Meeting. Present were, from left: J. Wachsmuth and Mr. Bell, Aluminum Co. of Canada Ltd.; B. Blair, vice-chairman; and Ry Cyr, second vice-chairman. Mr. Bell also showed a technicolor film on the mass production methods used by large automobile manufacturers in the United States. (Reported by R. V. Hutchinson)

A.S.M.—Leader in Promoting Engineering Education

In a recent talk before the Cleveland Chapter, Walter Morrison, A.S.M.'s director of public relations, gave every A.S.M. member good reason to be proud of the Society's educational efforts. What was said before the Cleveland group should be said again, here—to all A.S.M. members—as an over-all picture of what the Society is doing for the metals industry as a whole, and what the Society is actually doing NOW in support of the industry's immediate and future needs for properly trained experts in all phases of metallurgical operations.

First, let me review briefly what A.S.M. is doing for its thousands of members. Then I want to answer a serious question which was posed about a month ago. I believe you will be interested because the question seemed to be a challenge to our organization.

As a matter of current statistics, let me repeat here what most of you may already know—namely, that your Society now exceeds 26,000 members, with 95 chapters. This is indeed a sizable organization, and the services to you as members are among the most valuable of any technical organization.

In addition to the excellent opportunities you have as a result of meetings like this, A.S.M. provides you with what we believe to be some of the most essential forms of information yet devised.

Metal Progress, of course, is your chief source of current developments in the metalworking field. Through *Metal Progress,* industry expresses its problems and invites your solution. The profession of metallurgy at the same time is giving industry workable ideas and the benefits of broad experience by men who are trying to solve these problems.

The principal source of permanent engineering information on metals is the Metals Handbook "the Bible of the metals industry". It is, as far as I know, the largest single volume ever published on a single scientific and engineering subject.

As you know, there have been two supplements to the Metals Handbook, in 1954 and in 1955, both originally published as the 13th issue of *Metal Progress* and now available in bound form as supplements to the Handbook. The organization of material in these two supplements involved 41 A.S.M. committees. Now, 15 committees are busy organizing the material which will be incorporated in another large volume—a new edition.

In *Metals Review,* you as members can follow the pattern of activities in chapters like your own. In *Metals Review* you find accounts of personalities and their relationships to industry and the profession. Each month you will find annotations of articles, books, lectures and speeches important in your work. Each year these annotations are made available in a bound volume known as Review of Metal Literature; 11 volumes have already been issued, containing more than 85,000 separate annotations of scientific and technical articles.

The annual Metal Congress produces much that is important to you and to industry. The papers presented at the Congress are available as free preprints, and the papers, complete with discussions, are published each year in A.S.M. *Transactions.*

The National Metal Exposition is a source of vital information to everyone in the metals industry, whether in engineering, sales, production or management. The Metal Show is the largest annual industrial event in America. Each year over 400 leading industrial firms bring their products, production methods, materials, technologies and services so that you and thousands of others may know what is new, what is most economical and what is planned for the future. This is an A.S.M. production, a vivid and dramatic demonstration of progress in our industry.

A.S.M. is more than a service to you as individual members. On this platform last month a distinguished educator emphasized the dangers inherent in our present shortage of engineers, teachers, scientists and technologists. He said that only minor relief could be achieved unless American citizens, business men, and technical organizations bring some sort of pressure to bear upon school boards, politicians and legislators. This was not all, according to this educator. He posed a question—or rather two questions: How many of you men here have paid any personal attention to the school system in your own neighborhood?; and how much has your Society done toward the recruitment of students into technical colleges and to the improvement of the teaching profession?

Here is the answer—YOUR answer.

A.S.M. begins at the seventh grade in junior high school in its encouragement of science and engineering study. Your Society appropriates $15,000 annually to cover awards made to junior and senior high-school students in public, parochial and private schools in the U.S. and Canada for projects in any field of science or mathematics. Our belief, which is also the belief of leaders in education, is that interest in careers should be planted early in life. A.S.M. is doing something practical and substantial in support of this belief.

The A.S.M. Science Achievement Awards are for all science students in grades 7 through 12. They are designed to stimulate interest in science

Receives A.S.M. Scholarship at Detroit

Joseph Licht (Center), Metallurgy Student at Wayne University, Was Presented With an A.S.M. Scholarship at the Detroit Chapter's Annual University Night Meeting. Shown congratulating Mr. Licht are: C. A. Nagler (left), professor, department of chemical and metallurgical engineering, Wayne University; and A. D. Wagner (right), chairman of Detroit Chapter

through individual investigation and accomplishment; to identify and encourage the talented student to continue his or her science study; to open up the vast world of scientific and engineering achievement as incentive for further study in college as preparation for careers in metallurgy, the scientific research fields and other types of engineering.

A basic introduction to the subject of metallurgy is incorporated in the 95-page booklet, Your Career in the Metallurgical Profession, available to high-school science teachers, guidance counselors and students already committed to college training in metallurgy and other engineering fields. Over 35,000 of these booklets have been distributed, including copies sent to winners of Science Achievement Awards and A.S.M. Scholarships. A condensed version of the booklet is made available in large quantities for distribution to student groups, regardless of their direct interest in science or engineering careers. Over 225,000 copies of a leaflet, Does Engineering Appeal to You? have also been distributed. Many of you are familiar with these two career items. But I am wondering if many of you know the extent of good influence they have had on the younger generation.

It is not enough to know that a young student, finding himself qualified, is enrolled in a metallurgical course at college. A.S.M. firmly believes that we can increase our supply of engineers, particularly metallurgical engineers, by making sure that the interest and determination of these enrolled students are kept high. One of your Society's efforts helps in this respect. Each year A.S.M. awards $2000 to a young teacher of metallurgy for the best performance in this engineering field. The award holds up before the student body a convincing picture of the teacher's importance, thus increasing the student's confidence in the metallurgical field itself. Ten of these $2000 teaching awards have been made since the program was established four years ago.

Another reason for metallurgy's importance is expressed in the A.S.M. Visiting Lectureships. Engineering schools request that an outstanding personality be sent as an A.S.M. Visiting Lecturer, to conduct a two-day series of conferences, seminars and special meetings for the benefit of both student body and faculty. A.S.M. in turn notifies the requested lecturer and underwrites all costs of his visit to the participating school. Metallurgy students are thus encouraged and are better informed on special metallurgical subjects.

Two major programs are currently being carried on by A.S.M. through its Foundation for Education and Research. Scholarships of $400 each are distributed each year through 53 different engineering schools. These schools are selected on the basis that they offer a full day-time degree course in metallurgy or metallurgical engineering. A total of 146 of these scholarships have been awarded since the program was established in 1952.

Through the A.S.M. Foundation, the Society also awards a $4200 Fellowship to metallurgy degree holders who have had a least one year's experience in industry or nonacademic research and wish to return to school for a post-graduate degree. Judging of the winning entry in this Fellowship program is made by a special committee of the Foundation board of trustees.

Each year the Society cooperates with many state administrations in a two-week special training course in metals technology for vocational teachers. The program is designed to give added value to skilled trade instruction in all courses which involve the use or handling of metals—such as welding, machining and designing.

A.S.M. provides a capable teacher for this teacher-training course, organizes the instructional material, recommends the minimum laboratory facilities and provides an effective examination at the end of the course.

The vocational teacher-training sessions are for the purpose of upgrading the thousands of skilled trade students who study under an A.S.M.-trained vocational teacher and who would otherwise require a great deal of supervision, supervision by the very men who are in such short supply, the engineers. By increasing the number of technicians who will not need this time-consuming supervision, we will actually increase the supply of engineers.

What about the increase of engineering manpower through the efforts of A.S.M. chapters? I mention this last because I believe these activities are most important. Cooperation with the programs originating at National Headquarters has been and continues to be most gratifying. The Science Achievement Awards, the scholarships, fellowships and teaching awards are all made more effective and important because A.S.M. chapters, located in areas where these awards are made, give their support at the local level and participate in all activities connected with them.

More important still is the initiative of the chapters themselves. Chapter program committees and student affairs committees cover the local scene with many effective ideas and activities. Cooperation with schools, PTA groups and civic organizations provides A.S.M. with just the means needed to aid education in its struggle toward better science teaching, more science study and a greater potential of scientists and engineers.

Science teachers are invited to chapter meetings; talented students are introduced to the practical side of industrial operations and to the advantages of science and engineering as careers; open houses are held in local plants, organized by the local chapter, where both high-school teachers and students learn how industry does its great job of providing the means to our high standard of living; talks are given by members before student groups on the broad subject of industrial production and the special fields of engineering, particularly metallurgical engineering; local awards sponsored by the A.S.M. chapter are arranged; and local radio and television programs are spearheaded by the chapters.

A.S.M. as a whole is justly proud of its chapters' promotion of education at all levels. There is a steady increase in these activities.

In an address before the A.S.M. Annual Banquet in Philadelphia last October, Adm. H. G. Rickover, U.S.N., attached to the Reactor Development Division of A.E.C., paid high tribute to A.S.M. for its over-all effort in the field of engineering education. He indicated clearly that it was his conviction that the recruitment of future metallurgical engineers must begin while they are still in the secondary schools.

We agree with Admiral Rickover that the existing shortage of scientists and engineers, in the face of our rapid development, is certain to exist for many years to come. There are many problems. The American Society for Metals is trying to face these problems with practical realism. In other words, we recognize these problems and we believe we understand them. Much of our attention is directed toward solutions of the problems.

If there are qualified and interested students, from the seventh grade in junior high school, to the degree holder who seeks post-graduate training in metallurgy, one or more of our appeals and chapter efforts may well reach them and make definite and permanent a desire to pursue metallurgical engineering as a career.

Carolinas Talk Points Up Factors in Selecting Steels

Speaker: W. A. Schlegel

Carpenter Steel Co.

W. A. Schlegel, Carpenter Steel Co., presented a talk entitled "Selection of Alloy Steels" at a meeting held by the **Carolinas Chapter.**

Mr. Schlegel pointed out that it was the automobile manufacturers who first realized the need for alloy steels and so were responsible in large part for their development. Today there are over 1000 different steels, which is too many, making it difficult for most people to make a selection. Many times, instead of alloying, merely varying the heat treatment will accomplish the desired result. Mr. Schlegel cited examples where a machine which was first designed to be made of 14 different steels was finally reduced to two; another design requiring five different steels was reduced to one. He listed some of the effects of alloying, including greater hardness, less distortion, higher resistance to abrasion, and lower heat treating temperatures which result in less warpage.—**Reported by R. J. Polivka for Carolinas Chapter.**

Gives Sauveur Lecture in Philadelphia

At the 23rd Annual Sauveur Memorial Lecture of the Philadelphia Chapter, John Clark, Jr., Chairman, Presented the Honored Speaker, Kent R. Van Horn, With a Plaque Given in Recognition of His Outstanding Accomplishments in the Field of Metallurgy. Dr. Van Horn, director of research for Aluminum Co. of America, spoke on "Precipitation Hardening of Metals"

Speaker: Kent R. Van Horn
Aluminum Co. of America

Kent R. Van Horn, director of research, Aluminum Co. of America, was chosen to deliver the 23d Annual Sauveur Lecture of the **Philadelphia Chapter.** Dr. Van Horn, A.S.M. past-president, spoke on the "Precipitation Hardening of Metals". It was pointed out initially that the talk would stress the aspects of solid solution heat treatment and precipitation hardening other than the strength and hardness effects on other properties.

Dr. Van Horn stated that the fundamental requirement of solid solution heat treatment is that one of the phases, regardless of whether it is terminal or intermediate, must show decreasing solubility with decreasing temperature. On quenching, the precipitation does not immediately occur in many alloys and the subsequent aging treatment results in the hardening effect.

As an analogy, Dr. Van Horn said that steel is hardened by the change in crystal structure in a relatively short time interval. However, the precipitation hardening alloys require time at temperature for diffusion to occur.

The most popular theory for the high strength in the precipitation hardening alloys is the critical dispersion and particle size of the precipitant. However, a new theory presented is that the first precipitate is not in equilibrium, but is in a transition phase form. A high state of strain exists between this intermediate phase and the parent metal. Both the strain and the particle size of the transition phase affect the amount of increase in strength as well as in hardness.

One of the first properties covered was resistance to corrosion. Pure aluminum is strongly resistant to many acids and certain alkalies. The presence of other constituents generally reduces the resistance to corrosion in metals. An exception is if the surface film characteristic is changed, corrosion resistance may be enhanced. An example is the film that forms on stainless alloys.

In the precipitation hardening alloys, the distribution of particles is the most important factor affecting resistance to corrosion. The first precipitate occurs in the grain boundaries. Since the potential of the grain may be different than the boundary, galvanic action would be set up in the alloy unless grain boundary precipitation is avoided.

The change at different rates of the various properties of the precipitation alloys was next discussed. No change in tensile strength or hardness may occur, but a change in resistance to corrosion may result depending on the quenching technique employed.

On aging, the tensile strength will reach a peak and then fall rapidly as the aging temperature is increased. However, the conductivity will continue to increase, as the aging temperature is increased further until solution occurs.

The talk closed with a discussion of the effect of the precipitation phenomenon on volumetric stability, fatigue strength and the endurance limit.—**Reported by Louis F. Calzi for Philadelphia.**

They Came a Long, Long Way

Paul H. Anderson, head, department of metallurgical engineering, South Dakota School of Mines and Technology, accompanied by four students, recently attended a meeting of the Rocky Mountain Chapter in Denver. The group drove 400 miles to attend the meeting, and a similar group manages to make at least one meeting of the Chapter each year. Students were Howard Cox, Howard Jelinek, Sherrill Swenson and Andre Zoutte.

Schaefer Is Guest at Golden Gate

Adolph O. Schaefer, National President A.S.M., and Director of Research, Midvale-Heppenstall Co., and W. H. Eisenman, National Secretary, Were Guests of the Golden Gate Chapter at Its National Officers' Night Meeting. Mr. Schaefer talked on "Large Forgings". Shown during the meeting are, from left: Bill Matheson, incoming chairman; Mr. Eisenman; Mr. Schaefer; and Vic Walberg, retiring chairman. (Reported by R. D. Failor)

Interpretation of Tests and Correlation With Service Topic of St. Louis Series

Speaker: Irving Rozalsky

Shell Oil Co.

St. Louis Chapter recently completed an educational series covering the "Interpretation of Tests and Correlation With Service". The entire series was conducted by Irving Rozalsky, research metallurgist, Shell Oil Co. A.S.M. publications on the subject were used for text material.

Dr. Rozalsky divided his course into ten sections, as follows:

1. Destructive mechanical tests
2. Information gained from testing
3. Correlation of this information with service
4. Nondestructive testing
5. Testing limitations
6. Corrosion theory
7. Corrosion testing
8. Practical examples of tests plus failures
9. Practical examples of correlating tests
10. General discussion and summary.

One hundred and twenty members and nonmembers attended and many of the nonmembers joined A.S.M. after completing the course. Dr. Rozalsky presented a certificate of distinction to those who successfully completed the course.—**Reported by Robert Leslie for St. Louis.**

Explains Zone Melting at Oak Ridge

W. G. Pfann (Left), Bell Telephone Laboratories Inc., Who Spoke on "Zone Melting" at Oak Ridge, Is Shown With G. D. Kneip, Jr., Technical Chairman

Speaker: W. G. Pfann

Bell Telephone Laboratories Inc.

W. G. Pfann, Bell Telephone Laboratories Inc., spoke at a meeting of the **Oak Ridge Chapter** on "Zone Melting".

One important application of zone melting is in the zone refining of germanium and silicon for transistors. Minute quantities of elements of Group 3 and 5 of the periodic table have critical effects on the resistivity of these metals, as do iron, copper, and nickel on the minority carrier lifetime. Zone refining techniques can reduce the concentration of these impurities to one part in ten billion.

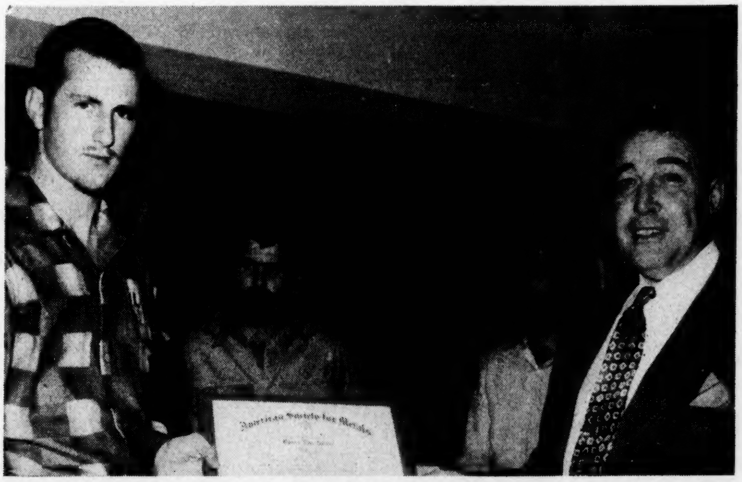
Mr. Pfann discussed normal melting and zone melting in terms of the distribution coefficient of the material and solute distribution in the ingot. He also reviewed several ingenious techniques used in this process. The simplest method involves passing the ingot in a boat or crucible through a ring heater, frequently an induction heater. In more complex methods, the molten zone of the ingot, without crucible, is supported by surface tension for a light metal, or by a magnetic field. A series of ring heaters accomplishes repeated purification. Metal of ultra-high purity produced in this way sometimes shows unusual properties. For example, highly purified aluminum can not be work hardened.

A continuous process of zone melting is also being developed in which feed enters, and product and waste leave the refiner continuously. Another technique involves a temperature gradient and produces fine zones of a few mils thickness.

Single crystals of uniform concentration can also be grown by a zone melting process called zone leveling.

The maximum size of ingots generally used in zone melting at this time is probably about 5 lb., but Mr. Pfann stated that this powerful new tool, zone melting, can be used on ingots weighing on the order of tons, as well as on a fine scale.—**Reported by Don Hendrix for Oak Ridge.**

A.S.M. Scholarship—Texas Style



The A.S.M. Foundation Scholarship Hasn't Grown a Beard . . . Only the Winner Has, in This Case, M. Z. Walker of Texas Western at El Paso. The hirsute appendages of the two in the background have unidentified owners, but J. C. Rintelen (right), chairman of the school's department of mining and metallurgy assures us that Mr. Walker (left) makes up for his delayed growth of beard by the quality of his grades. He won the $400 scholarship and was a close contender for the "scroungiest" beard prize. Each year the mining and metallurgy students at Texas Western travel up to Ore Grande, one of the old mining districts north of El Paso, where they live and try to look like the veteran miners during their brief stay

Metallurgical News and Developments

Devoted to News in the Metals Field of Special Interest to Students and Others

A Department of *Metals Review*, published by the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio

New Plant—A new plant which houses the fast-growing furnace division of the Pacific Scientific Co. opened in Los Angeles in April. William J. Parsons, vice-president of Pacific's industrial operation, and former secretary of Los Angeles Chapter A.S.M., said that the move was sparked by steadily increasing orders for custom-built and extra large furnaces from Western industry.

To Supply Airline—AiResearch Mfg. Co. will develop all air conditioning, cabin pressurization and engine-starting equipment for the $100-million fleet of Electra airliners that Eastern Airlines has ordered from Lockheed.

Testing Leather—Leather can be tested without destroying it by a new sound wave method just announced by National Bureau of Standards.

Welding Titanium—Research developments in spot and seam welding of titanium are listed in a handbook available from the Office of Technical Services at the Commerce Dept.

Gold Aluminum—A method of producing nonfading gold-colored aluminum in a variety of shades and tones has been developed by Kaiser Aluminum & Chemical. Source of the color is built into the metal itself; the color is brought out by anodizing under readily controlled conditions.

Acquires Company—Lindberg Industrial Corp., Chicago, has purchased the good will, drawings and other assets of Jet Combustion Co. Jet specializes in rotary forge furnaces and other large steel mill heating equipment.

Welding Lab—Worthington Corp.'s new welding research laboratory, which opened early in March, was designed to provide the company with increased service in the application of advanced welding techniques for the design and manufacture of its 11 major products. The lab will be used for welding application research, designing for welded construction and building of prototype models, and for training programs for welding operators, supervisors and technicians.

Synthetic Gem—A synthetic, gem-like material harder than any substance known except diamond, promises to be a remarkably efficient and inexpensive industrial substitute for the hardest tungsten steels and carbides which have made the U. S. dependent on Asiatic sources of the rare tungsten. The material, Sintox, is made by Sintox, Inc., Allentown, Pa.

Shell Molding Machine—The world's largest shell molding machine, for pattern size 36 x 36 in., was installed in the steel foundry at U. S. Steel's National Tube Division. The two-station unit will produce castings up to 34 in. square and smaller castings arranged in multiple patterns on the two 3-ft.sq. pattern plates.

Expansion—A multi-million dollar expansion program in the atomic power field has been announced by Sylvania Electric Products Inc. First step in the program, which will extend over the next five years, will be new production and development facilities for nuclear fuels and components.

Sets Up Bank—A unique particle bank, with deposits ranging in size from milligrams to pounds of selected powder samples, has been established by Stanford Research Institute. The bank is accumulating and distributing a wide variety of powders for research uses by university, industrial and governmental laboratories.

Plastic Tooling — An intensive research program on "Properties of Plastics Used for Tooling Applications" has been initiated by American Society of Tool Engineers research fund. A $10,000 contract has been awarded to the Purdue Research Foundation, where work will be carried on under the direction of O. D. Lascoe, department of general engineering.

Super-Sonics — 50% or more of tomorrow's super-sonic planes will consist of stainless steels, according to a prediction by Republic Steel Corp., which has recently increased by 18% its stainless manufacturing facilities.

Awards Contract—Ford Motor Co. has awarded a contract to Gas Machinery Co., Cleveland, to furnish annealing furnaces for their Canton forge plant in Ohio.

Titanium Recovery—A new way to recover titanium scrap has been announced by Watertown Armory. The process, called the meniscus melting method because of the crescent shape of the melted surface, converts titanium scrap into usable ingots. In current fabrication, 25% of titanium ends up as scrap. The process is still in the development stage.

Present Service Plaque in Kansas City

W. H. Eisenman, National Secretary (Left) and Chapter Chairman R. R. Griner (Right) Are Shown Presenting a Plaque to Fred McCoy, Chief Metallurgist, Sheffield Steel Co., for His Continuing Leadership and Service to the Chapter Since Its Inception in Kansas City. (Report by D. C. Goldberg)

Current Status of Titanium Discussed At Savannah River

Speaker: D. W. Levinson
Armour Research Foundation

D. W. Levinson, supervisor of nonferrous research, Armour Research Foundation, presented a discussion of the "Status of Titanium Development" at a meeting of the **Savannah River Chapter.**

Dr. Levinson pointed out that during the last year there have been more advances in most phases of titanium technology than in previous years.

A significant development was the establishment by the Defense Department at Battelle Memorial Institute of the titanium metallurgical laboratory, implementing the conclusion of the Defense Department that titanium will be of substantial value in military equipment.

Research and development contracts have continued to increase the available knowledge of titanium alloys. The existence of an embrittling transition phase, omega, in the transformation of beta to alpha for beta stabilized alloys has been proved. This solves the mystery of anomalously hard and brittle beta which frequently occurred and was called beta prime. Practical heat treatments to avoid and stabilize alloys against omega formation have been developed by Frost and co-workers at Battelle.

The need for selecting alloys for extended high-temperature service under stress on the basis of "stability" tests is now accepted. Stability is defined in terms of little or no loss in room-temperature tensile ductility of a specimen after exposure to high-temperature creep conditions appropriate to the intended application. The superior performance of predominantly alpha-phase alloys, solid solution, strengthened by aluminum for such applications is rapidly being demonstrated.

No entirely new alloy compositions were offered commercially during the past year. However, much experience has been gained with the fairly new 3% Mn-complex and 6% Al, 4% V commercial compositions. The 6-4 composition has been engineered into a current production jet engine.

Other experimental alloys being examined in laboratories throughout the country include a 7%, Al, 3% Mo alloy developed at Armour for superior performance at high temperatures and stresses. This alloy looks better in creep at 1000° F. than any tested so far and it is stable.

The titanium industry is in better shape with respect to forging alloys than the sheet compositions. The 8% Mn has been the principal sheet alloy but has given trouble with uniformity, hydrogen susceptibility, general stability and weldability, as well as inadequate strength. Progress has been made in commercial improvement of this material. The 5% Al, 2.5% Sn sheet alloy, which is all alpha, is stable and weldable but no stronger than the 8% Mn and is incapable of heat treatment to provide higher strength. It is also more difficult to form than the 8% Mn. Sheet alloys are desired with good formability, high strength, stability and weldability. This is a challenge to alloy design. It probably means that the alloy will have to be solution treated and quenched to provide the low yield and high uniform elongation necessary for good forming, then aged to high strength for service. The quenching of large sheets and the aging of aircraft assemblies involve difficult problems.

Progress was also made on the hydrogen problem. A program at Wright Air Development Center and a number of private investigations have provided reasonably safe specifications that avoid the hydrogen problem. Examples of precautions include controlling sponge storage and handling to avoid moisture; melting in vacuo or under reduced gas pressure; not employing reducing atmospheres in heating for working operations; and closely controlling pickling operations. One hundred twenty-five ppm. of hydrogen is a tentative safe maximum for most alpha-beta type alloys.

Assuming that titanium of uniformly satisfactory quality is producible and that fabrication problems can be ironed out, manufacturers will need a large and steady supply. Du Pont and Titanium Metals Corp. can now operate at 3600 tons per year. Dow Chemical is in production and should reach a contracted capacity of 1800 tons per year late in 1956. Union Carbide will have a 7500 ton per year unit in operation in 1956. This is the first production process to abandon the Kroll method in favor of sodium reduction of tetrachloride.

The actual production in 1954 was a little over 5000 tons and the expected output this year is about 15,000 tons. If full production in currently contracted capacity is met, the capacity at the beginning of 1957 should be over 22,500 tons.—**Reported by E. A. Orr for Savannah River.**

Compares Aluminum Processing Methods

Donald H. Tilson (Left), Aluminum Co. of America, Spoke on the "Processing of Aluminum in the United States and Yugoslavia" at a Meeting Held by St. Louis. He is shown with chairman-elect Herbert A. Ball

Speaker: D. H. Tilson
Aluminum Co. of America

A recent meeting of the **St. Louis Chapter** featured a talk by Donald H. Tilson, works manager of the Aluminum Co. of America, on the "Processing of Aluminum in the United States and Yugoslavia".

Mr. Tilson recently served as a consultant for the International Bank for Reconstruction and Development on a mission to Yugoslavia to investigate the aluminum industry in that country. He illustrated his lecture with many slides which he was allowed to take in this "Iron Curtain" country because of his connection with the International Bank.

Of considerable interest was Mr. Tilson's observation that an aluminum plant could be put into operation in Yugoslavia to process only 300,000 lb. a day, whereas a plant would not be constructed in the United States unless it could produce at least 1,000,000 lb. a day. Transportation of raw materials, the use of monohydrate, few or no plant safety devices, complete control of labor unions by the plant director and very cheap labor, all would be considered inadequate, inefficient and quite strange in this country but are common in Yugoslavia.—**Reported by Robert D. Leslie for St. Louis.**

At Pacific Northwest Officers' Conference

Representatives of the Five Pacific Northwest Chapters Who Met Recently in Seattle to Discuss Present and Future Chapter Activities Included, Seated, From Left: Larry Chockie, Columbia Basin; Barney Holder, Puget Sound; Bill Slosson, Puget Sound; John Stokes, British Columbia. Standing, from left, are: Charles Cumming, British Columbia; Bill Smith, Columbia Basin; Jim Gustafson, Oregon; John Rector, Columbia Basin; Ted Mathisen, Oregon; J. P. McCulloch, British Columbia; Amon Groves, Inland Empire; Jim Bates, Oregon; and Dave Meslang, Puget Sound. (Photograph taken by Fran Krill, Inland Empire Chapter)

Details Methods of Ultrasonic Testing At Rockford Chapter

Speaker: Norman W. Schubring
General Motors Corp.

At a recent monthly meeting of the **Rockford Chapter,** Norman Schubring, research engineer, General Motors Corp., gave a lecture on the "ABC's of Ultrasonic Inspection".

Mr. Schubring first went into the theory of ultrasonics and how it could be used for nondestructive inspection purposes. As frequency of sound waves rises above the audible range (20,000 cps.) toward the value of several megacycles per second, the waves behave more and more like light waves. Thus, for example, at 1 megacycle per second, a beam of sound waves can be produced with an arc of 7 to 8°. This phenomenon forms the heart of all ultrasonics. As the beam obeys the laws of reflection and refraction, it can be reflected off of the solid-air interface that would be found at a crack or void in a material. It is this reflection feature which is the most important basis for all of the present ultrasonic testing methods.

Mr. Schubring then described the transducer, a material which converts one type of transmissionable energy into another type of transmissionable energy and is the material which has made ultrasonics possible. In ultrasonic testing, the transducer used is commonly an X-cut quartz crystal. This material exhibits the piezo-electric effect characteristic of interchanging electrical and mechanical impulses. The transducer has made ultrasonics possible because it can be made to vibrate in the inconceivably high-frequency ranges employed in ultrasonics.

The field of ultrasonics can be divided into two levels—high and low. In high ultrasonics, the medium transmitting the impulses is permanently changed. Examples of this type of use include destruction of tissue, altering of genes, aging of whiskey, homogenizing of milk, refining of the grain size in metals, etc.

In low ultrasonics, the medium is not permanently changed. Thus, the application of ultrasonics to nondestructive testing falls within this category.

The speaker explained the methods in current use for inspection: the pulse-echo; the resonance; and the transmission type. The pulse-echo method can be thought of as a type of radar. The impulse is generated by the crystal and transmitted through the material being tested. Any interface which the waves come in contact with will cause a reflection which may be picked up by the test equipment. The main drawback of this method is that the input pulse of vibrations has a finite width. If a flaw exists at a distance beneath the surface such that its echo occurs during the pulse time, the flaw echo is masked out. The second method of testing is the resonance method. With this method, ultrasonic vibrations of varying frequency are introduced into the material. The frequency at which resonance is obtained is indicated by either audible or visible means. The frequency at which resonance occurs is a function of depth so that if a flaw is present, its depth can be determined. This method is also used for testing bonded assemblies. The third method, transmission, is the simplest, theoretically. The waves are passed through the material and, if a flaw exists, it will block the path of the impulses and the receiver on the other side of the material will not be able to pick up the transmission. Thus, the ratio between the quantity of vibration sent and the quantity received is a measure of the soundness of the material. The excellent lecture was terminated by a question and answer period and a display of the resonance and transmission-type testing equipment now in use.—**Reported by Donald R. Adolphson for Rockford.**

IN RETROSPECT

An editorial in the July 1924 issue of the *Transactions* of the American Society for Steel Treating (early name of A.S.M.) states that "65% of the members of the society attended the convention last year—a record never paralled in the history of any technical organization".

♦ ♦ ♦

Establishment of a special "Research Bureau of Metallurgy" at Carnegie Institute of Technology—undoubtedly the roots of the present famed "Metals Research Laboratory"—was announced in the summer of 1924. FRANCIS M. WALTERS, JR., previously an associate physicist at the National Bureau of Standards (more recently in the Research Department of the Atomic Bomb Laboratory, Los Alamos, N. M., and now deceased) was appointed director of the Bureau, and V. N. KRIVOBOK, who had just received his Sc.D. degree from Harvard under Professor Sauveur's direction (now Development & Research Div., International Nickel Co., Inc.) was named as an assistant.

♦ ♦ ♦

Personal items include an announcement that EDGAR C. BAIN (now vice-president of research and technology of U.S. Steel Corp., and an A.S.M. past president) had resigned as research metallurgist for Atlas Steel Corp. and accepted a position with Union Carbide and Carbon Research Labs, Long Island City, N. Y.

♦ ♦ ♦

Also noted is the fact that Dr. WILLIAM CAMPBELL (deceased) was appointed first Howe Professor of Metallurgy at Columbia University.

♦ ♦ ♦

The first paper on stainless steel to be published in the A.S.M. *Transactions* (September 1924) was "Stainless Steel and Stainless Iron" by O. K. PARMITER, metallurgist, Firth Sterling Steel Co. (still chief metallurgist for Firth Sterling, now in partial retirement). The paper traced the history and development of the 13% chromium type. Mr. Parmiter concludes, prophetically, "It might be said that the application of stainless steel and its modified forms is yet in its infancy. It is possible that the future may revolutionize manufacturing costs to such an extent that the steel will be available in any quantity".

♦ ♦ ♦

Another pioneering contribution in the same issue was "Application of X-Ray Crystal Analysis to Metallurgy" by W. P. DAVEY, physicist, research laboratory, General Electric Co. Two examples were cited—one showing how arrangement of atoms in metals gives a rational explanation of relative ductilities, and the other illustrating the mechanism of solid solution. The late Dr. DAVEY was more recently research professor, School of Chemistry and Physics, Pennsylvania State University.

Carburizing Trends Given at Detroit

Present at a Meeting Held by the Detroit Chapter Recently Which Featured a Talk by E. S. Rowland on "Trends in Carburizing" Are, From Left: A. D. Wagner, Chairman; Dr. Rowland; and C. A. Siebert, Technical Chairman

Speaker: E. S. Rowland

Timken Roller Bearing Co.

Members of the **Detroit Chapter** heard E. S. Rowland, chief metallurgical engineer, Timken Roller Bearing Co., present a talk entitled "Trends in Carburizing".

Dr. Rowland prefaced his talk by citing the results of an inquiry he had made of a dozen people representing organizations doing production carburizing. The following interests were expressed in all the replies:

1. Control of case depth and maximum carbon content.
2. Influence or at least awareness of residual stress.

Dr. Rowland based his talk on the results of studies of the above factors in his own organization.

Before presenting the results, Dr. Rowland outlined the steels and test methods used. Most of the work at Timken has involved the nickel-molybdenum and nickel-chromium-molybdenum steels AISI 4620 and 4720, and the nickel-chromium "Krupp" steel (corresponding to AISI 3310-3317). Carbon gradients were measured on short lengths of heavy walled tubing, using 0.005-in. cuts. Case depths were measured to 0.50% carbon on the gradient curve, or to a depth corresponding to 0.50% carbon using M_s procedures (details for which are available in the paper by Rowland and Lyle entitled "The Application of M_s Points to Case Depth Measurement", A.S.M. *Transactions,* Vol. 37, 1946, p. 27).

Dr. Rowland then presented a series of charts showing the spread of carbon gradient determinations over a long period of time, representing random sampling during production carburizing. The carburizing conditions included pack carburizing in a tunnel furnace, gas carburizing with raw natural gas in a retort furnace, generator gas enriched with natural gas, hydrocarbon fluid ("oil drip" method) and continuous gas carburizing. The control conditions included manual control, dewpoint recorder with manual control, dewpoint control, and automatic carbon potential control with the sensing wire in the carburizing atmosphere. Dr. Rowland showed the spread of results obtained and summarized the results by stating that, from the standpoint of control of both surface carbon and case depth, there is a real advantage in simplicity. Any deviation from a simple system (such as continuous processing) is accompanied by loss of control and requires costly instrumentation to regain it. He felt that for production carburizing with semiskilled labor, instrumentation was inevitable and his company is currently making a direct comparison of dewpoint and sensing wire control on one furnace.

In considering the influence of residual stress, Dr. Rowland presented the results of X-ray diffraction measurements obtained at Timken. The most interesting facts resulting from the study were that carburized bearing rings exhibited consistent residual compressive stresses in the order of 15,000 to 20,000 psi. to a considerable depth below the surface, while through-hardened AISI 52100 steel exhibited tensile stresses to about the same extent. Both steels, subjected to production grinding procedures, exhibited compressive stresses on the surface of the order of 30,000 to 40,000 psi., apparently due to grinding alone. Subjecting carburized parts to −320° F. after heat treatment did not change the residual stress pattern to any significant extent.

In the discussion period following the talk, Dr. Rowland indicated that Timken regarded high carbon cases (in the order of 1.05 to 1.10% carbon) desirable, as long as massive carbide was absent; fine globular carbides are not considered detrimental. **—Reported by D. V. Doane for Detroit Chapter.**

Speaks in Texas on Stainless Steels

V. N. Krivobok, International Nickel Co. Inc., Who Spoke on "Stainless Steels and Heat Resistant Alloys" at a Meeting of Texas Chapter, Is Shown, at Left, With Donald E. Wilson, Chapter Chairman. (Photo by Shelby Herron)

Speaker: V. N. Krivobok
International Nickel Co.

Members of the **Texas Chapter** recently heard a talk on "Stainless Steel and Heat Resistant Alloys" by V. N. Krivobok, Development and Research Division, International Nickel Co., Inc.

The talk covered a great deal of the metallurgical technology on stainless steels. Of particular interest was the discussion on precipitation hardening stainless steels. Dr. Krivobok stated that the major development work on these steels is completed and the usage of these steels will increase very rapidly because of their many desirable characteristics.

During the lecture, Dr. Krivobok was asked if he had any knowledge of the formation of microscopic transverse fissures in 17-4-PH stainless steel. He stated that he had heard of such phenomena but that, personally, he had never seen it. It was inferred that this type of defect is quite rare.

Dr. Krivobok called to the attention of the group the recent formulation of a new series of stainless steels, the 200 series and Types 201 and 202, already available. These steels are similar to the 300 series of stainless steels, except the nickel content is greatly reduced and is replaced with manganese. It is understood that in nearly all respects these steels are directly equivalent to similar Type 300 steels.—**Reported by D. F. Saurenman for the Texas Chapter.**

Talks in Milwaukee on Heat Resisting Alloys for High-Temperature Applications

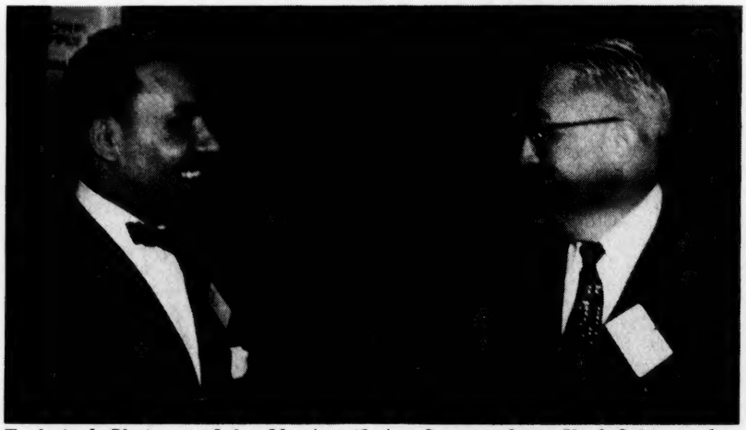
Speaker: E. N. Skinner
International Nickel Co., Inc.

"Heat Resisting Alloys for High-Temperature Applications" was the subject discussed by E. N. Skinner, Jr., head of the high-temperature materials section, Development and Research Division, International Nickel Co. Inc., at a meeting of the **Milwaukee Chapter.**

Alloy selection in this field is made chiefly on the basis of three factors —physical, chemical and mechanical properties. Under these broad headings, of specific importance are structural stability, oxidation resistance and thermal stresses. With regard to the last point, in using quenched materials, it is wise to keep section thickness to a minimum to reduce such stresses.

The speaker felt that the present-day high-temperature alloys have been exploited to about their capacity in terms of service temperature and stress-carrying abilities. Future developments appear to lie with the cermets, ductile chromium and molybdenum.—**Reported by P. W. Ramsey for Milwaukee Chapter.**

Cites Points for Improving Quenching



Technical Chairman John Monfre (Left) Congratulates Karl Schauwecker, Service Metallurgist, U. S. Steel Corp., Following Mr. Schauwecker's Talk on "Improved Quenching of Steel by Propeller Agitation" at Milwaukee

Speaker: Karl Schauwecker
U. S. Steel Corp.

Karl Schauwecker, service metallurgist, U. S. Steel Corp., discussed "Improved Quenching of Steel by Propeller Agitation" at a meeting held by the **Milwaukee Chapter.**

A comparison of the severity of quench for air, oil, water and brine with various degrees of agitation was presented, and the importance of proper circulation required to reduce pocketing or stagnant areas was emphasized. The three stages of heat transfer, (*a*) vapor, (*b*) vapor plus liquid, and (*c*) liquid, which occur in quenching, were discussed and an excellent movie showing these conditions, for both quiet and agitated baths, was presented. This was followed by an analysis of the turbulence produced by propellers, the horsepower required and the improvement in results that can be expected when the source of agitation is correctly located and the quench tank properly designed.

An interesting question and answer period followed the talk. — **Reported by Donald Kedzie for Milwaukee.**

Lehigh Hears Talk On Quality Control

Speaker: John W. W. Sullivan
American Iron and Steel Institute

"The Application of Statistical Quality Control Principles to Metallurgical Problems" was described by John W. W. Sullivan, metallurgical engineer, American Iron and Steel Institute, at a recent meeting of the **Lehigh Valley Chapter.**

Mr. Sullivan stated that statistical quality control is used to analyze variability so that it can be controlled through corrective action. Such action is warranted if the variability is more than can be tolerated from a quality standpoint, or if improvement in either variability or level of quality will reduce costs or increase production. Statistical quality control procedures can facilitate corrective action by distinguishing between variations due to chance causes and those due to specific causes. Thus, the total variation in a given property or attribute may be beyond specification limits, yet a sizable fraction of it may be due to controllable causes. If these can be determined and eliminated, the variability may be reduced to satisfactory limits or the average level of the property may be shifted so variability can be tolerated.

The proper and most efficient method of analysis to use depends on the nature of the problem. If a large number of factors are possible causes of variation, it will usually save time to plot the results against the corresponding values of each suspected cause separately, discarding all causes which show no signs of direct influence. More involved statistical procedures can then be applied to evaluate the degree of influence of the remaining variables.

Statistical quality control of a repetitive operation is frequently achieved through use of charts showing the average and range of a small group of samples taken at regular intervals from the production line. Usually, excessive deviation of group averages from the desired value indicates factors operating at the wrong level, such as improper machine adjustment. A large variability or range within groups indicates lack of reproducibility caused by insufficient control of one or more factors affecting the quality. For example, the impracticability of melting steel to exactly the same analysis on successive heats causes variations in hardenability from heat to heat.

The application of sampling techniques to maintain inspection efficiency at predetermined levels at a fraction of the labor and cost of 100% inspection was described. Typical case histories of inspecting tin plate and ammunition shell bodies illustrated the effectiveness of this method of inspection. The sample size is chosen so that a known small, yet tolerable, percentage of bad material will on the average be accepted along with the good. Also a small percentage of good material will be rejected along with the bad. The proper sample size can be calculated in each case from statistics on the current level of quality, the lot size and the selected, small percentages of bad material to be accepted and good material to be rejected. The value of this method is further appreciated when it is recognized that 100% inspection is rarely 100% effective, due to personal errors and operator fatigue.—**Reported by R. H. Holloway for Lehigh Valley.**

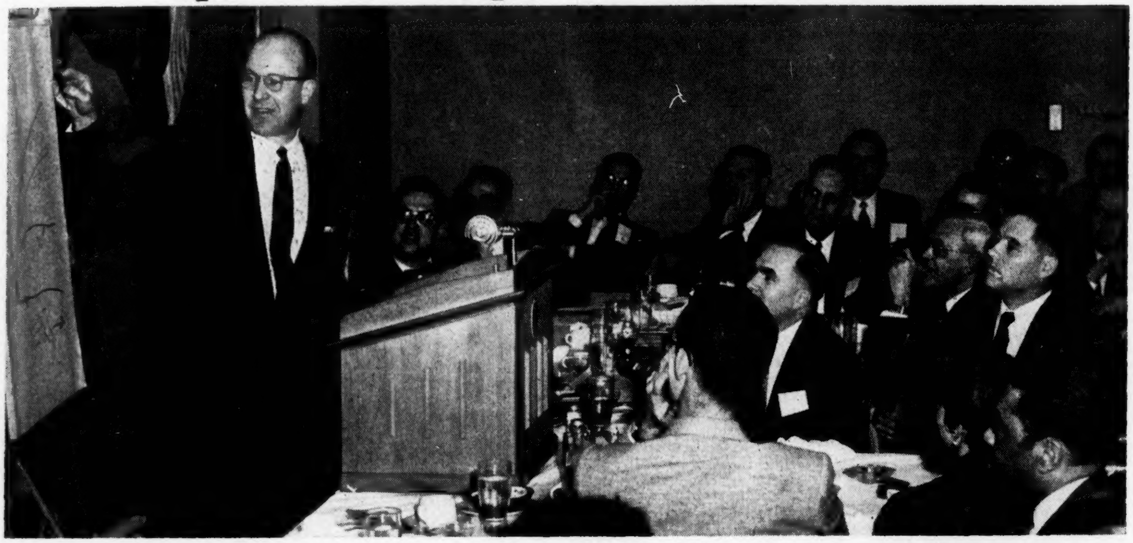
Jackson Chapter Receives Charter

National President A. O. Schaefer and National Secretary W. H. Eisenman Presented the Charter to the Jackson (Mich.) Chapter Recently. Mr. Schaefer spoke on the "A.S.M. of Tomorrow" and Mr. Eisenman presented a history of the A.S.M. Shown above are, from left: Chairman John A. Richter; Vice-Chairman Charles R. St. John; Secretary Glenn E. Berry; Mr. Eisenman; and Mr. Schaefer. (Reported by Charles R. St. John)

Attend Symposium Given in India

Shown Above Is a Group of Delegates and Guests Who Attended the Symposium on "Production, Properties and Applications of Alloy and Special Steels" Organized by the National Metallurgical Laboratory in Jamshedpur, India. In the front row, from left, are: K. N. Srivastava, F. H. Schonwalder, J. F. Sewell, B. R. Nijhawan, Mrs. Maitra, E. H. Bucknall, Mrs. Nijhawan, J. McFarlane, V. Cadambe, R. Faivre, M. V. Patankar, T. Banerjee and Sadao Koshiba. The symposium, inaugurated by M. S. Thacker, director of scientific and industrial research at the Laboratory, was a tremendous success from all angles. Not only was it international in the sense of including delegates from overseas, and contributions from workers abroad unable to attend, but in the sense that it attained the standards of international technical conventions in respect to the quality of papers presented and tone of the discussions following

Speaks at Tri-Chapter Meeting in Columbus



Gordon B. Carson, Dean of Engineering at Ohio State University, Is Shown as He Delivered the Talk at the Dinner Meeting Which Closed the All-Day Tri-Chapter Sessions Held in Columbus Recently. Dr. Carson presented a talk entitled "Solving Our Technical Manpower Problems". Over 230 persons attended the meeting

The Tri-Chapter Meeting of the **Cincinnati, Dayton and Columbus Chapters** was held at the Ternstedt Division plant of General Motors Corp. in Columbus. Approximately 230 persons attended the meeting and were welcomed by J. Harry Jackson, chairman of the Columbus Chapter, and John A. Broden, works manager at Ternstedt. Harry B. Goodwin of Battelle Memorial Institute introduced the speakers during the morning session and conducted the discussion periods. "A Look Into the Future" was the theme of the presentations.

M. W. Lightner, U. S. Steel Corp., who spoke on "Future Developments in Iron and Steel", discussed the increasing importance and recent expansion of research. Fields for future ferrous developments include use of taconites, sizing of blast furnaces charges, desulfurization of pig iron, oxygen steelmaking, continuous casting, vacuum melting, high-strength and aircraft steels, high-temperature alloys and surface treatment of metals.

S. F. Radtke, Reynolds Metals Co., presented a talk on "Future Developments in the Light Metals Field". He pointed out the competitive nature of the light metals industry and the increasing demands for aluminum and magnesium. Properties and applications were discussed for both metals, and doubled production by 1965 with numerous new applications was predicted. Need for new alloys of aluminum and the experimental work being conducted on auto engines were also pointed out.

Roydon S. Pratt, Bridgeport Brass Co., spoke on the "Future in Copper and Brass Alloys", covering history, price comparisons and uses. He stressed the need for better castings, continuous processes, development of extrusions and other products. He also predicted that an increase in supply is expected soon.

"Future Developments in Titanium" were discussed by T. W. Lippert, Titanium Metals Corp. of America. Titanium is now six years old; two years ago it was a laboratory item. Titanium sheet and foil are now in production and industry no longer considers it a specialty product. Costs are being reduced from the ingot to finished product. Alloys with 110,000 to 120,000-psi. yield point in the annealed condition are now being made. The speaker predicted that within two years we will have heat treatable alloys of 170,000-psi. yield point for use at 1000° F. and in three or four years we will have materials of 200,000-psi. yield point.

During the afternoon session, Joseph Spretnak, Ohio State University, introduced the speakers and conducted the discussion periods.

James W. Freeman, University of Michigan, discussed "Future Developments in High-Temperature Metals". Cermets now have some applications but more research is necessary. Molybdenum alloys and intermetallic compounds hold promise, but iron and nickel do not give too much hope. Aerodynamic heating produces fabrication problems. Gas turbines for autos are here and we need an alloy cheap enough to compete—good die castings may be the answer. Power plants must go to high alloys for 1200° superheaters. Vacuum melting has shown the significance of minor trace elements and produces alloy steels of more precise compositions.

"Metallurgical Aspects of Atomic Energy and Rare Metals" were discussed by David W. Lillie, General Electric Corp. The nuclear business is still in its infancy and low-cost fuels are an important need. Uranium and thorium are now used. Uranium has three phases and this presents a design problem due to changes in dimensions during irradiation and also during heating and cooling. Plutonium has six phases and spectacular properties. Expansion and contraction both occur during heating. Thorium, fortunately, has but one phase.

Power by nuclear units is still expensive, and new materials and designs are necessary to reduce costs. The engineer and metallurgist hold the key to the future development of this industry.

A cocktail hour and dinner at the Everglades Restaurant were enjoyed by many of the members attending the meeting.

In the evening, Gordon B. Carson, dean of engineering, Ohio State University, presented a talk entitled "Solving Our Technical Manpower Problems".

The people who are most concerned with this problem are the scientists, technicians and engineers. The salary ranges for these groups were discussed. Many engineers are moving into management and need to be replaced. Shortages also exist for high-caliber technicians. Jobs are therefore plentiful for graduating engineering students—each one has approximately ten offers. The audience was urged to look around home and influence young people to adopt engineering careers. — **Reported by R. S. Corder for Columbus Chapter.**

Fort Wayne Hears Talk on Cold Extrusion Process

Speaker: R. W. Perry

Parker Rust Proof Co.

Ross W. Perry, manager of the Cold Forming Division, Parker Rust Proof Co., presented a talk entitled "It's Easier to Move Than Remove Metal" before a recent meeting of the **Fort Wayne Chapter.**

Mr. Perry explained that cold extrusion is the process of pushing around a given quantity of metal until it assumes a usable shape and surface finish, as contrasted with the usual manufacturing procedure of taking a larger piece of metal and throwing away that portion which is machined off to produce the desired shape. Currently being cold extruded are such items as truck wheel nuts, differential side gears, drive pinions, hydraulic valve lifter parts, starter gears, gas cylinders, hydraulic cylinders, etc.

Until three years ago, Mr. Perry stated, production installations for cold extrusion were mostly on ordnance items, with a few small shops taking the initiative on a few high-production items. More recently, major parts producers (including major automobile organizations) have gone into this field in earnest.

To further qualify the truth of his talk's title, Mr. Perry stated that the stop light switch, for example, had formerly been turned from cold drawn hexagonal stock on screw machines. This same switch is now, after certain design modifications, cold extruded. In processing this switch, wire is sized, sheared and cold headed to produce slugs of uniform weight at 160 per min., with no loss of metal. These slugs are then annealed and Bonderite and Bonderlube treated, and then formed on a single press to finish shape. The parts are then drilled, roll threaded and shouldered on a screw machine, after which they are plated as a finished part. Because it is cold extruded, it is being sold at about 40% of the previous price and at a much more favorable profit. In fact, the total cost of manufacturing is less than the previous cost of material.

The chief advantages of cold extrusion include the following: Cheaper base metal because hot rolled rod or bar stock can often be used instead of cold drawn material; scrap savings due to requiring reduced amount of raw material (conventional methods can result in scrap losses to 70% due to chips, etc.; reduction or elimination of machining due to close tolerances and excellent surface finishes resulting from the cold work operations; reduced labor due to high production rates; higher production rates per dollar invested; greatly improved surface finish (depending upon the extent of cold working) with the finishes approaching those produced by rough honing; closer tolerances; with proper press facilities and tool design, cold work tooling will produce parts of uniform dimensions for long periods of operation without interruption, as contrasted to the high maintenance required on other types of production tooling; and improved physical properties. The severe cold working of the low carbon steels improves their physical properties to meet or surpass the requirement previously set for parts manufactured from alloy steels.

The visual part of this talk, in addition to a number of slides, included several large panels which displayed parts and sections of parts being produced by cold extrusion.—**Reported by J. P. Crosbie for Fort Wayne Chapter.**

Talks at Dayton Meeting on Cermets

Present at a Meeting Held in Dayton Were, From Left: L. W. McBride, Vice-Chairman; R. P. Koehring, Past Chairman; George Stern, American Sinteel Corp., Guest Speaker; H. J. Reindl, Chairman; and G. R. Stockmeier, Executive Committee. Mr. Stern presented a talk entitled "Cermets for Refractory and High-Temperature Metals Achieved Through Powdered Metals"

Speaker: George Stern

American Sinteel Corp.

George Stern, vice-president and technical director, American Sinteel Corp., spoke before the **Dayton Chapter** on "Cermets for Refractory and High - Temperature Metals Achieved Through Powdered Metals". He described the over-all aims of high-temperature metallurgy and related some of the limitations of conventional alloys for these applications. The method of cermet manufacture was also outlined.

Mr. Stern pointed out that the cemented carbides were the initial start for the cermets, which were defined as being chemical compounds usually combined with a binder metal. Examples were grouped as being either a combination of a metal oxide and a metal, a metalloid with a metal binder, or a pure intermetallic compound. Cermets were shown to possess most of the desirable properties for high-temperature applications except for their brittleness tendency and low impact resistance. These undesirable factors have hindered their general use for aircraft applications; however, research now in progress has brought about improvements in the brittleness tendency. Mr. Stern stated that cermets can be the answer for highly oxidizing conditions existing over 2000° F. The upper limit for the nickel and cobalt-base high-temperature alloys was said to be about 1800° F. because of their poor stress rupture and creep resistance properties above this temperature. Cermets therefore can push beyond the conventional high-temperature alloys and the superalloys for extreme high-temperature use. Mr. Stern emphasized that there is need for a material to meet all of the desirable properties for high-temperature application such as good heat shock resistance, oxidation resistance, creep resistance, stress rupture resistance, microstructural stability and good impact resistance. Cermets possess most of these factors and may be the answer to many future high-temperature requirements.

Cermets are manufactured by the cold press method, the hot press method, and the hydrostatic press method. They are used for such applications as thermocouple protection tubes, crucibles for melting aluminum, and pump parts that are in contact with corrosive acids. Other applications include brazing furnace fixtures and some use as brake linings for aircraft. Mr. Stern said that much of the future of cermets lies in the requirements of the military needs. The ultimate properties required in high-temperature applications have not been met to date through metals; therefore cermets may be the answer. Mr. Stern optimistically predicted a gradual trend toward increased use of cermets in the future.—**Reported by Walter J. Ridd for Dayton.**

Delivers Burgess Lecture in Washington

A. B. Kinzel, Union Carbide & Carbon Corp., Delivered the Burgess Memorial Lecture Before Washington Chapter. Shown, from left: M. Myerson, chairman; Dr. Kinzel; and A. V. Astin, National Bureau of Standards

Speaker: A. B. Kinzel

Union Carbide & Carbon Corp.

The Seventh Annual Burgess Memorial Lecture was given by Augustus B. Kinzel, vice-president of research, Union Carbide & Carbon Corp., before the **Washington Chapter**. Dr. Kinzel, who spoke on "Research and Trends in Alloy Steels", was introduced by A. V. Astin, director of the National Bureau of Standards. Dr. Burgess, in whose honor the lecture is given, was director of the Bureau from 1923 until his death in 1932.

Dr. Kinzel stated that metallurgy is a science which draws on the three basic sciences—chemistry, physics and mathematics. In the field of chemistry, advances in the knowledge of oxygen and combustion provided the basic information needed for successful steelmaking. In the late twenties, the chemists derived the equation for the general kinetics of slag metal reactions in the openhearth furnace, and the Bureau of Standards showed the CO and CO_2 relationship in molten iron. Dr. Kinzel expressed the view that at the present time theories of physical chemistry dictate the practice in steelmaking.

From the field of physics, metallurgy has been provided with some of its most powerful tools—the microscope and X-rays.

Mathematics is used to study relationship between alloying elements in steels and hardenability. It has shown that alloys have a multiplying effect rather than being additive.

Dr. Kinzel stated that metallurgy is on the threshold of its greatest advances. The best pig iron will be developed by removing the silicon, lowering the carbon and superheating the iron. The improved condition will cause electric furnace steel to be cheaper than openhearth steel. The cost differential between alloy steels and carbon steels will be less, and consequently, the total production of alloy steel will increase. Also, in the future, research will discover more about vacuum melting and we will then have new, higher quality alloy steels. Dr. Kinzel is convinced that metallurgists will produce commonly used steels with tensile strengths exceeding 280,000 psi. and possessing excellent ductility.

The physicists, through tracer techniques, will learn how to orient crystals to give steels with higher properties.

In closing, Dr. Kinzel re-emphasized that the future of metallurgy has never looked brighter.—**Reported by H. P. Weinberg for Washington.**

Record Class Completes Course Given in Rochester

A record number of 90 students were awarded certificates during a recent meeting of the **Rochester Chapter** for completion of the first of a three-year planned educational program entitled "Practical Metallurgy".

The actual nightly attendance during the 17-week duration of this series numbered up to 144 but the 90 who received certificates qualified under the attendance requirements. Twenty-six companies in the Rochester area were represented and it is interesting to note that more than half of those officially completing the course were personnel from sustaining member companies.

Incorporated into this series was the use of the A.S.M. book, "The Nature of Metals", films and slides. Past Chairman John J. Hoffer, metallurgist at the Hawk-Eye Works of Eastman Kodak Co., presented the entire series. The last two nights of the session were devoted to visits to Rochester Steel Treating Works and Lindberg Steel Treating Co.

Frank E. Trevett of Delco Appliance Division, General Motors Corp., as chairman of the educational committee, headed the group which formulated this educational program, which will be continued for the next two years as "Applied Metallurgy", Part I and Part II. It is planned that the A.S.M. textbook "Basic Metallurgy" will be used.—**Reported by Frank J. Gehrlein for Rochester.**

Presented A.S.M. Scholarship Award

James G. Barker, Right, a Metallurgy Student at the Massachusetts Institute of Technology, Is Shown Receiving the Scholarship Certificate Presented by Boston Chapter Chairman, J. L. Morosini, Representing the A.S.M. Foundation for Education and Research. (Photo by H. L. Phillips)

Explains Formation of Crystal Nuclei in Liquid Metals at Ottawa Valley

Speaker: David Turnbull
General Electric Co.

"Formation of Crystal Nuclei in Liquid Metals" was the subject of an address given before the **Ottawa Valley Chapter** by David Turnbull, manager, chemical metallurgy section, Research Laboratories, General Electric Co.

Dr. Turnbull pointed out that many of the concepts of the freezing behavior of liquid metals are based on observations by Fahrenheit over 200 years ago in his attempts to use water as a fixed temperature standard. He observed that pure water could be undercooled 30° F. without freezing. Variability of this temperature of undercooling from sample to sample led to the conclusion that foreign agents present in the liquid were responsible for the nucleation of the solid phase.

The theoretical work of Gibbs indicated the energies required to form the surface of a new solid phase and led to the concept of critical nucleus size to permit freezing. Not until the 1920's did researchers focus attention on rates and mechanisms of the nucleation process.

Recent attempts to study freezing behavior of pure liquids have shown undercooling of up to 300° for iron and 240° for copper in experiments with very fine droplets. Also established is that the most significant factor in the efficiency of a nucleating agent is the degree of registry between the lattice of the foreign agent and that of the matrix material.

Such studies as these and newer work on constitutional undercooling have shed considerable light on the structure of castings and the role of impurities as nucleating agents. **—Reported by E. Teghtsoonian for Ottawa Valley.**

OBITUARIES

ROBERT W. BUZZARD, a project leader in the metallurgy division of the National Bureau of Standards, died suddenly of a heart attack while attending a conference of the Atomic Energy Commission at Ames, Iowa, on May 3. He had been an active member of Washington Chapter for many years.

Mr. Buzzard was born in Fenton, Mich., in 1904 and received B.S. degrees in chemical engineering in 1926 and metallurgical engineering in 1933, from Michigan State College.

Prior to his employment at the National Bureau of Standards in 1927 he was employed at the Navy Department.

For many years Mr. Buzzard worked on the development of anodic coatings for the protection of aluminum and magnesium alloys against corrosion. He holds several patents in this field. For the past several years he has supervised a group of metallurgists engaged in the development of constitution diagrams of alloy systems of metals particularly important to the Atomic Energy Commission.

During World War II, Mr. Buzzard, then a major in the Ordnance Reserve, was ordered to active duty in 1942. He served in the African and European theaters and was awarded the Bronze Star Medal as well as two service medals. He was promoted to lieutenant colonel, returning to the National Bureau of Standards as a civilian after the conclusion of hostilities.

He is survived by his wife and three daughters.

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F. R. MCCRUDDEN, an engineer with the Homecraft Manufacturing Co., died of a heart ailment early in April. Mr. McCrudden, a member of the New Jersey Chapter, was born in Montreal and came to the U. S. 40 years ago.

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G. M. KELLER, 33, laboratory authority on metal finishing and electroplating with the Naval Research Laboratory, died of cancer at his home late in March. He had been ill since November.

Mr. Keller was a member of the Washington Chapter.

Gives Corrosion Factors in Detroit

Shown at Detroit Chapter's University Night Meeting Are, From Left: G. H. Robinson, Technical Chairman; and Mars G. Fontana, Ohio State University, Who Spoke on "Metallurgical and Mechanical Factors in Corrosion"

Speaker: M. G. Fontana
Ohio State University

The **Detroit Chapter** played host to the metallurgical students of Michigan colleges and universities at the annual University Night meeting. M. G. Fontana, chairman of the metallurgical engineering department, Ohio State University, spoke on "Metallurgical and Mechanical Factors in Corrosion".

Dr. Fontana pointed out that most failures are due to environment and abuse, although the metal itself may be at fault in some cases. He stated that the electrochemical theory requires that a cell exist, and that a current flow between anodes and cathodes in the corrosion process. The so-called general type of corrosion is greatly affected by the purity and homogeneity of the metal. He cited the behavior of aluminum in hydrochloric acid as an example of purity of the metal, pointing out that 99.2% Al corroded 30,000 times faster, and 99.7% Al, 1000 times faster than 99.998% Al. Impurities and multiphase alloys present the possibility of setting up minute galvanic cells. Precipitation hardening stainless steels, intergranular corrosion, erosion-corrosion, sigma phase and pitting of stainless steels were discussed. Corrosion of spheroidized carbon steel in acid did not occur with normal pearlite. Dr. Fontana illustrated the effect of nonhomogeneity with a number of lantern slides showing instances of rapid corrosion from this cause.

An excellent moving picture, produced at Ohio State University, was presented which showed the propagation of stress corrosion cracks. The evolution of hydrogen bubbles could be clearly seen emanating from the crack as it propagated. The application of a reverse current stopped the progress of the crack and hydrogen evolution, but they started immediately when the reverse current was removed from the circuit.**—Reported by C. A. Siebert for Detroit.**

Describes Favorable Uses for Titanium

B. S. Mesick, Arthur D. Little, Inc., Addressed the Los Alamos Chapter on "Favorable Applications for Titanium as an Engineering Material". Shown are, from left: Daniel J. Murphy, program chairman; Dr. Mesick; and Robert T. Phelps, chairman. (Photograph by Clayton O. Matthews)

Speaker: B. S. Mesick

Arthur D. Little, Inc.

B. S. Mesick, engineering consultant and West Coast representative of Arthur D. Little, Inc., and formerly coordinator with industry on the Department of Army Titanium Program, addressed the **Los Alamos Chapter** on "Favorable Applications for Titanium as an Engineering Material".

Dr. Mesick traced the phenomenal growth of titanium metal as an engineering material based on tonnages of sponge produced and mill products shipped. He pointed out that in the short time since 1948, sponge-producing facilities have increased from 10 tons to some 9000 tons, and paralleling mill products shipped now approach some 2000 tons, according to latest available figures. The growth curve is still rising and with the completion of new plants, a sponge production of 22,500 tons is expected by 1957. Projected plans for further expansion of facilities indicate that a figure of 35,000 tons per year may be reached by 1959 or 1960.

Dr. Mesick went on to say that commercially available supply is now several times the demand. Definite progress is now being made toward improvements in mill products. The demand for better design properties has led to an extensive program for the development of alloys of titanium. While the corrosion resistance characteristics of titanium are outstandingly favorable, the basic reason for the use of titanium as a structural material is its strength/weight advantage, especially for applications that encounter operating temperatures of 300 to 800° F. Other desirable properties, such as greater stiffness and ductile weldability, are also important objectives which must be obtained without sacrifice of high strength levels. Considering all of the factors influencing alloy development, Dr. Mesick stated that he felt the ultimate titanium alloy will be one that can be heat treated to high strength levels (over 150,000 psi.) while still retaining the required ductility and impact toughness.

It appears that the controlling factors in the current use of titanium as a structural material are whether the structure being considered must move and whether the reduction in weight to be gained justifies the increased costs due to the use of titanium. The present high prices for titanium mill products (about $9 per lb.) have tended to limit their use to aircraft. Price analysis, taking full advantage of the favorable strength/weight ratio of such an alloy as the readily forgeable 6Al-4V titanium base alloy, indicates that it would be necessary for such titanium forging stock to sell for about 75c per lb. to make it economically feasible to substitute titanium for steel in connecting rods of standard automobile engines.

While, for such applications, titanium may not compete for some time to come, there are many other specific uses, particularly in marine service, where the superior corrosion resistance and the good appearance of titanium after long exposure to corrosive environments more than offsets the difference in price.

The problems encountered by titanium as an infant industry are not unlike those which hampered the growth of the aluminum and stainless steel industries not long ago. High prices, production difficulties and small volume production are obstacles yet to be surmounted. Dr. Mesick, who has been intimately involved in the development of titanium all through its period of rapid growth, and who has been a key figure in the impetus which titanium usage has received in military applications, expressed confidence that the production and consumption of titanium will continue to increase and that the titanium industry will expand in the foreseeable future to an annual production rate of several hundred thousand tons of mill products.—**Reported by Daniel J. Murphy for Los Alamos.**

Meet Your Chapter Chairman

DAYTON

HAROLD J. REINDL was born in Mansfield, Ohio, and attended grade and high school there. He graduated from the University of Dayton with a B.S. degree in chemical engineering in 1942 and went to work as a metallurgist at the Inland Division of G.M.C. In 1951 he was appointed assistant chief metallurgist at Inland. During the past ten years he has taught several courses in chemistry and engineering materials at the University of Dayton.

Harold is married and has three children. He is a member of several technical and fraternal organizations and has been active with the Dayton Chapter for many years. He served on the Dayton Chapter executive committee for two years before being elected vice chairman and chairman. His present hobbies are woodworking, model making and photography.

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SAGINAW VALLEY

THOMAS E. LEONTIS, chief, casting section, metallurgical laboratory, Dow Chemical Co., was born in Plainfield, N. J. He graduated from Stevens Institute of Technology and received advanced degrees from Carnegie Institute of Technology. He served as a chemistry instructor at Stevens after graduation and as a metallurgist at Vanadium Corp. of America before coming to his present position.

Tom has one boy. He is active in technical and social organizations and is fond of bridge, golf and reading in his spare time.

Schaefer Speaks in St. Louis

The National Officers' Night meeting held by the **St. Louis Chapter** featured a talk on the "Manufacture and Heat Treatment of Large Steel Forgings" by National President Adolph O. Schaefer, director of research, Midvale-Heppenstall Co.

Mr. Schaefer, who has presented this same talk before many of the A.S.M. chapters during the past year, prefaced his technical talk with an up-to-date summary of the progress being made on the five-point program of the "A.S.M. of Tomorrow." A discussion period concluded this most successful meeting. — **Reported by Robert D. Leslie for St. Louis.**

Tells How Industry Uses Ultrasonics at Baltimore Meeting

Speaker: John C. Smack
Sperry Products, Inc.

Members of the **Baltimore Chapter** heard a talk on "Industrial Applications of Ultrasonics" by John C. Smack, sales staff engineer, Sperry Products, Inc.

Ultrasonic vibrations are now used extensively by industry to do many new jobs, as well as old jobs, with greater efficiency. Ultrasonics refers to mechanical vibrations in air, liquids and solids in the range of frequencies from 20 kc. to 100 mc., and experimentally as high as 1000 mc. The transducers used to generate these vibrations are mechanical—high-frequency sirens and whistles in the range of 35 kc., magnetostrictive nickel rods in the range of 50 kc., and piezo-electric materials up to 100 mc. The latter may be Rochelle salts, quartz, ceramics, barium titanate, lithium sulphate or others.

The ultrasonic frequencies may be continuous, pulsed or resonant, and may be destructive or nondestructive. They may be grouped insofar as applications as follows:

1. Nondestructive includes testing, inspection and measuring of materials, especially metals.
2. Destructive or physical changing of materials, usually liquids. Progress in this group has been restricted due to lack of equipment with sufficient power.
3. Degassing and descaling using the principles of cavitation.

Specific applications for ultrasonics cited by Mr. Smack included:

1. Inspection of materials through measurement of thickness, physical properties or change in structure.
2. Sound navigation and ranging through the use of sonar.
3. Measuring velocities of liquids in pipes, etc., by flow meters.
4. Degassing fluids such as water and oil by using cavitation.
5. Increasing the rate of descaling during pickling operations.
6. Dispersing fine particles in powdered metals, dyes, paints, etc.
7. Experimental detection of cancerous growths, gall stones, etc.
8. Activating alarm systems through a change in air movement in the path of low frequencies.
9. Measuring viscosity of oils and other fluids.
10. Precipitating particles in stacks.
11. Impregnating wood fabrics, oiling bearings, penetrating fungicides, etc.
12. Accelerating the emulsification of resins, oils and water solutions, the fermentation of alcohol, extraction of hops in processing beer, and other mechanical processes.
13. Drilling and grinding metals and other materials employing a slurry of fine abrasive particles.
14. Drilling odd-shaped hoes in hard materials such as carbides, glass, etc.
15. Soldering tips or vibrators at temperatures as high as 1600° F. for fluxless brazing.

Many examples were given of ultrasonics in widely used applications, particularly for the nondestructive testing of metals, and the latest equipment was described.

The use of automation and equipment for completely automatic, programmed inspection for identical parts such as jet engine wheel-shaped forgings and large caliber gun barrels was also described.

Ultrasonic inspection now includes equipment which will automatically scan within a definite pattern and signal presence of defects within predetermined ranges of size.—**Reported by John S. White for Baltimore.**

National Officers Go Western

National Officers' Night of the Alberta Chapter Featured a Talk on the "Application of Emergency Metallurgy to Peacetime Work" by President A. O. Schaefer, Director of Research, Midvale-Heppenstall Co., and a Talk on the "A.S.M. of Tomorrow" by Secretary W. H. Eisenman, Messrs. Schaefer and Eisenman were to have had a meeting with Mayor D. H. MacKay, but due to inclement weather they were detained somewhere in Oregon, under a snowbank. They arrived in Alberta, the Stampede City, in time for the evening meeting and Alderman James MacDonald presented them with the traditional white cowboy hats on behalf of the mayor. Mr. Eisenman said they were going to Edmonton the next day and hoped they would get suits to match the hats. Shown are, from left: Mr. Eisenman; Mr. MacDonald; Mr. Schaefer; and Otto Kingsep, chairman of the chapter

Akron Sponsors Series on Ferrous Casting Principles

Approximately 150 registrants from the Akron area participated in a six-lecture educational program on the "Principles of Ferrous Castings", held on successive Wednesday evenings from Mar. 28 through May 2 at the University of Akron.

Leading men of the metalworking and foundry industry served as instructors and helped to make the program successful. Many of the local companies showed their interest by sponsoring the attendance of employees who wished to take part in the program.

Speakers and the talks they presented included:

"Pattern Design", by E. E. Thompson, superintendent, pattern department, Unitcast Corp.

"Molding and Coremaking", by R. L. Gathmann, metallurgist, Babcock and Wilcox Co.

"Melting and Pouring", by C. F. Bunting, chief metallurgist, Barberton Division, Rockwell Manufacturing Co.

"Heat Treatment of Ferrous Castings", by Joseph Calkins, metallurgist, Unitcast Corp.

"Techniques of Precision Castings", by R. W. Dively, castings coordinator, Goodyear Aircraft Corp.

"Properties of Ferrous Castings", by L. W. Hudson, chief metallurgist, Goodyear Aircraft Corp.

The Lebanon Steel Foundry film "Steel With a Thousand Qualities", and the Monsanto Chemical Co. film, "Shell Molding" were shown during the program, and the Steel Founders Society of America book, Steel Castings Handbook, was given to each person registered for the course.

Members of the Akron Chapter's educational committee who directed the program included: M. Goldman, chairman, A. R. Nasrallah, R. P. Shimkus, F. R. Lisic, and L. W. Hudson, of Goodyear Aircraft Corp., Gilbert Reymann, Atlantic Foundry, and Wayne Alley and C. F. Bunting, Rockwell Manufacturing Co.—**Reported by M. Goldman for Akron.**

Receive Gifts From Texas Chapter

National Secretary W. H. Eisenman (Left) and National President Adolph O. Schaefer (Center), Guests at the Texas Chapter's National Officers Night Meeting, Are Shown Receiving Gifts of Texas Belts From Donald E. Wilson, Chairman. Mr. Schaefer presented a talk entitled "Manufacture and Heat Treatment of Forgings". (Photograph by Lee Dolan for Texas)

Electric Furnace Brazing Topic at Rockford Meeting

Speaker: R. D. Richards

General Electric Co.

At a meeting of the **Rockford Chapter,** R. D. Richards, industrial heating specialist, Apparatus Sales Division, General Electric Co., gave a talk entitled "Electric Furnace Brazing".

The lecture was divided into four portions—examples of brazing applications, brazing theory, brazing equipment, and the question and answer session.

Mr. Richards discussed examples of a number of parts which are now fabricated by brazing the various component parts together. He explained how this method of joining, in comparison to others, reduces the cost per part, increases the strength of the part at the joint, causes the parts to have a more pleasing appearance, reduces the weight, and, at times, is the only economical method to produce the part. The majority of the examples discussed were ferrous but he also touched on the brazing of brass and aluminum.

Mr. Richards then discussed the basic theory of brazing. He explained the action of wetting and the alloying of the brazing material with the parts to be brazed. The action of the furnace atmosphere and fluxes, if used, was explained. He brought out the fact that the reducing atmosphere is usually the best flux to use.

Commercial fluxes have a detrimental effect on the heating elements in the furnace or on any metallic portion of the furnace, such as an alloy mesh belt, that they may come in contact with. As there is no commercial atmosphere that will promote the brazing of aluminum, fluxes have to be used.

Another feature which tends to increase the difficulty of brazing aluminum is the close proximity of the melting temperature of the brazing material and the aluminum parts. Thus, very close temperature control is necessary.

One of the most interesting and informative portions of the lecture concerned the relation of design of the joint in the strength of the braze. An extruded hole is superior to a punched hole as there is more area for the joint. The extent of the gap or clearance between the parts to be brazed is a function of the material being brazed and the design.

Mr. Richards then went into a discussion of brazing equipment and furnace handling problems. He covered the box and hump types of furnace and explained when each is to be used. He used examples to illustrate how they are stacked in the furnace and how they move through it and are cooled.

During the question and answer session, the question was brought up concerning the affect of a high brazing temperature on grain size when a low carbon material is being brazed with copper. Mr. Richards felt that, as the time at that temperature is so short, just sufficient to melt the copper, there would be little, if any, detrimental grain size effect. **—Reported by Donald R. Adolphson for Rockford Chapter.**

National Officers at Canton

At a dinner meeting of the **Canton-Massillon Chapter,** 74 members and guests heard National Officers A. O. Schaefer, president and director of research, Midvale-Heppenstall Co., and W. H. Eisenman, secretary, speak.

Following a short address by Mr. Eisenman, who presented awards to sustaining members, Mr. Schaefer gave a very enlightening talk on the "Testing and Inspecting of Steel Forgings".**—Reported by E. S. Rider for Canton-Massillon.**

Past Chairmen Guests of Cincinnati

Past Chairmen of the Cincinnati Chapter Were Honored at a Recent Meeting During Which Francis G. Tatnall, Manager of Testing Research, Baldwin-Lima-Hamilton Corp., Presented a Talk Which Was Entitled "Relation Between Engineering and Metallurgy". Past chairmen who attended included, from left, first row: M. H. Brumble (1940-41); G. H. Gerdes (1941-42); W. Whalen (1953-54); A. L. Hartley (1945-46); W. M. Ball, Jr. (1942-43); W. D. Archea (1935-36); N. C. Strohmenger (1936-37); R. O. McDuffie (1930-31); and Russell Hastings (1950-51). In the second row, from left: John B. Caine (1939-40); Reid L. Kenyon (1932-33); William A. Maddox (1947-48); Owen Williams (1951-52); and Tom A. Waltz (1937-38). (Reported by Al Strohmenger for the Cincinnati Chapter)

Points Out Relation of Metallurgy to Design at Meeting in Springfield

Speaker: H. R. Neifert

Timken Roller Bearing Co.

Members of the **Springfield Chapter** recently heard H. R. Neifert, supervisor of railroad research, Timken Roller Bearing Co., discuss the "Relation of Metallurgical Factors to Design".

Mr. Neifert's talk dealt mainly with fatigue failures. Fatigue limits of about one-half the ultimate static tensile strength of alloys, as obtained from conventional R. R. Moore fatigue tests, are not adequate for all design practices. Mr. Neifert stated that at least four factors affect fatigue behavior of full-size parts, tending to produce inferior results as compared to test results on small specimens. These are: processing methods which produce unfavorable residual stresses; the shape of the part; surface finish of the part; and susceptibility of the material to stress concentration. It was pointed out that hardened and tempered alloy steel shafting having sharp notches behaves no better than carbon steel shafting of the same dimension.

Mr. Neifert described the testing of large shafts such as used for railroad axles and propellor shafts of ships. Two parts are tested simultaneously as cantilevers at both ends of a drive mechanism. The machines operate at 1500 rpm. and the parts are run to destruction or, if failure does not occur, to 85 x 10^6 cycles.

Two fairly simple methods are available for improving fatigue behavior of steel shafting used for applications such as railroad axles, in addition to modification of design. Cold rolling introduces residual compressive surface stresses approaching a maximum of 100,000 psi. and diminishing to zero at 1 in. below the surface in a railroad axle. This improves resistance to fatigue failure by about 100% in the area where the wheel is press fitted to the axle.

Conventional quenching and tempering produces a residual compressive surface stress of about 6000 psi. in large shafting. If, following tempering, the shaft is reheated to a subcritical temperature near 1000° F. and quenched in water, residual compressive surface stresses of 27,000 psi. are produced. This procedure improves fatigue strength about 100%.

Stress relieving to remove residual tensile stresses following cold straightening raises fatigue limit from 13,000 to 17,500 psi.

Mr. Neifert closed his talk with a correlation between hardness and fatigue strength for ferrous materials. Both properties rise at first, but ultimately bending fatigue strength decreases as hardness continues to increase.—**Reported by Carl A. Keyser for Springfield.**

Ductility in Tubular Goods Described

Fred Prange, Phillips Petroleum Co., Spoke on "Ductility Problems in Oil Country Tubular Goods" at a Meeting in Texas. Shown are, from left: Russell F. Goff, vice-chairman; Mr. Prange; and Donald E. Wilson, chairman of the chapter. (Photograph by Lee Dolan for the Texas Chapter)

Speaker: Fred Prange

Phillips Petroleum Co.

Fred Prange, metallurgical and corrosion engineer in the engineering department, Phillips Petroleum Co., presented a talk on "Ductility Problems in Oil Country Tubular Goods" at a meeting held in **Texas.**

As a background for his talk, Mr. Prange pointed out that the tensile stress in oil well tubular goods, assumed to have uniform section, is about 2 psi. per ft. of well depth. Also, bottom hole pressures in oil wells may be as high as 1 psi. per ft. of well depth. Especially in deep wells corrosion is one of the more important metallurgical problems. This corrosion is due largely to carbon dioxide and hydrogen sulfide. Also, hydrogen embrittlement is important. Hard steels are more subject to hydrogen embrittlement. Mr. Prange suggested the possible use of surface protection of the steel, such as the Kanigan process of nickel plating or the possible use of precipitation hardening stainless steels as a means of combatting embrittlement. When corrosion resistant steels are used, another problem is introduced. This is the tendency for such steels to gall easily as threaded connections are screwed together.

Major mill defects in tubular goods are transverse cracks at forged upsets, piercing and drawing marks, and outside seams. These defects can be found by magnaflux or similar processes. However, oil country tubular products are not often so inspected at the mill because of the expense involved.

According to Mr. Prange, Phillips Petroleum has kept a record of failures of oil country tubular products. This record shows a definite relationship between failures and high hardness in the steel. It is believed that lack of transverse notched ductility is one of the major contributing factors in failure. As a result there are many failures at points of plastic deformation. It was noted that oil well tubing is not impact tested with such tests as the V-notch Izod specimen. Mr. Prange stated that when the yield strength of the metal is 100,000 psi., the V-notch Izod impact should be 20 to 30 ft. lb. minimum.

Phillips is running a test program on oil well tubular products using the so-called "C-ring" test. A length of tubing has a section removed so that the resulting test specimen is in the shape of a C. This specimen is then flattened so that the forces resisting flattening are at the midpoint of the C, where a shallow notch is introduced. Flattening loads, to failure, are recorded. This test is especially important in determining transverse properties of tubular products.—**Reported by D. F. Saurenman for Texas Chapter.**

Discusses Rolling of Steel At Saginaw Valley Meeting

Speaker: W. W. Hintalla

U. S. Steel Corp.

At a recent meeting of the **Saginaw Valley Chapter,** William W. Hintalla, assistant chief metallurgist, Gary Sheet and Tin Mill, U. S. Steel Corp., presented a talk entitled "Process Metallurgy for Rolling Steel".

Mr. Hintalla discussed the problem in the processing of slab to automotive sheet. Factors included grade selection, hot rolling, continuous pickling, cold reducing, annealing and temper rolling. He illustrated his talk with a series of slides.

A special feature of the meeting was the showing of Standard Oil Co.'s film "The Story of Lubricating Oil", which told the story of oil from the oil well to end use and the processes necessary to make better oils for today's engines.—**Reported by J. P. Clark for Saginaw Valley.**

Talks on Carbonitriding at Rochester

From Left: John B. Given, International Business Machines Corp., Lloyd Marshall, Metallurgist, Delco Appliance Division, General Motors Corp., N. J. Finsterwalder, Vice-Chairman, and Frank Trevett, Chairman of the Educational Committee, Are Shown at a Meeting of the Rochester Chapter. Mr. Given presented a talk which was entitled "Control of Carbonitriding"

Speaker: John B. Given

I. B. M. Corp.

John B. Given, staff metallurgist, International Business Machines Corp., spoke on the "Control of Carbonitriding" at a recent meeting of **Rochester Chapter.**

It took only a little over two years to build I.B.M.'s new facilities in Endicott, N. Y., which embody the most advanced concepts in working conditions, production equipment, materials handling and layout. Production capacity was to be increased 50%, with ample provision for expansion in the next five years, together with obsoleting about half of existing equipment, which made it extremely important to utilize the most advanced processes and equipment available.

That this program was successful was proven by the achievement of unusually comfortable working conditions and cleanliness of operations which are notorious for being hot, smoky, odorous and dirty. Much of this was accomplished by the use of controlled atmospheres and the processes of carbonitriding, gas carburizing and bright tempering.

Mr. Given stated that the adoption of gas carburizing completely eliminated pack carburizing and the use of cracked hydrocarbons in pit-type furnaces, both of which are known to generate plentiful quantities of dust and soot. The main feature of the bright tempering installation is the cleanliness of the work itself through the elimination of scale.

The carbonitriding process was adopted on the basis that 80% of the parts which were being case hardened in activated cyanide baths would lend themselves to this process and with a total of approximately 60,000 individual parts involved, the decision to convert such a large portion of the salt bath production was a major one. Each one of these parts carries a master card containing all of the necessary information for the complete control of heat treatment of the part by any operator on any shift.

The parts involved consist of mechanisms for feeding cards or tapes, sensing devices, counters, analyzer units and high-speed printing mechanisms. All of them must operate at high speeds, some with little or no lubrication. Small contact surfaces with extremely high unit loads require optimum surface hardness. Extremely close tolerances for flatness and dimensions must be maintained and many parts are made from strip steel only 0.040 in. thick. Mr. Given pointed out that the major part of I.B.M.'s heat treating consists of light case work with case depth tolerances ranging from 0.002 to 0.003 in. to 0.015 to 0.030 in. Case depths above 0.010 in. comprise only about 10% of the total. Steels used are AISI B-1113, C-1117, C-1010, C-1018, 8617 and 8620.

Mr. Given explained the technical steps taken to govern the control of the carbonitriding process which involves the physical properties and structures required, the limitations of the process itself and the equipment to be used. A number of slides showed results of various experiments conducted on different parts and pictures of the equipment installations showed the advantages of careful planning to obtain maximum efficiency of production.

In summary Mr. Given stated he was justly enthusiastic toward the carbonitriding process for turning out a better product at less cost and with greatly improved working conditions.

The meeting was concluded by honoring the Sustaining Members of the Chapter and the presentation of certificates to 90 students who completed the educational course.—**Reported by Frank J. Gehrlein For Rochester Chapter.**

Compliments

To Past National President GEORGE A. ROBERTS, on being elected vice-president of technology of Vanadium-Alloys Steel Co. Dr. Roberts joined Vanadium in 1941, advancing from research metallurgist through the post of chief metallurgist to his present position as vice-president of technology. He is also a director of Vanadium-Alloys Steel Canada, Ltd.

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To WILLIAM SPRENGER, manager of manufacturing, industrial heating department, Westinghouse Electric Corp., on his retirement after 30 years with the company. He is a member of the Northwestern Pennsylvania Chapter.

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To D. K. CRAMPTON, director of research and development, Chase Brass & Copper Co., Inc., on being selected to present the fifth Gillett Memorial Lecture at the 59th Annual Meeting of A.S.T.M. on June 19. He will speak on "Structural Chemistry and Metallurgy of Copper".

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To HERBERT C. VACHER, head of the metallographic and X-ray diffraction laboratory, National Bureau of Standards, on being awarded the Silver Medal for Meritorious Service by the Department of Commerce for his contributions in the field of metallurgy. A staff member for 30 years, Mr. Vacher has conducted important research and written many articles on the mechanical properties and structures of metals and alloys.

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To WILLIAM D. MCMILLAN, International Harvester Co., on being elected an honorary life member of the American Foundrymen's Society for his outstanding contributions to the ferrous castings industry. To HAROLD F. BISHOP, on being awarded A.F.S.'s Joseph S. Seaman Gold Medal for outstanding contributions to castings research at the Naval Research Laboratories. To CHARLES C. SIGERFOOS, associate professor, department of mechanical engineering, Michigan State University, on being selected to receive the Thomas W. Pangborn Gold Medal of the A.F.S. for his contributions to the castings industry, particularly in the field of education of engineering students for foundry careers. To JAMES S. VANICK, research metallurgist, International Nickel Co., on being awarded the W. H. McFadden Gold Medal of the A.F.S. for valuable service to the ferrous castings industry.

Presents Talk on Use and Development of High Speed Steels in Springfield

Speaker: Norman I. Stotz

Braeburn Alloy Steel Corp.

Norman I. Stotz, president, Braeburn Alloy Steel Corp., reviewed the latest trends in the "Use and Development of High Speed Steels" at a meeting of the **Springfield Chapter.** Mr. Stotz' talk was illustrated by a graphic summary showing figures for annual consumption of the major grades of high speed steel in terms of percentages of total shipments. Last year's figures showed shipments as follows: Total of tungsten types —13%; total of molybdenum types —87%.

Analysis of Mr. Stotz' graphs showed the following detailed breakdown of high speed steel shipments during 1955:

Type	Cr	V	W	Mo	% of 1955 total
T-1	4	1.2	18	—	8.3
M-1	4	1.2	1.75	8.50	24.0
M-2	4	1.9	6.25	5.25	42.0
M-10	4	2.0	—	8.25	17.0
High-cobalt T-type					3.1
High-vanadium T-type					1.6
All other M-types					4.0

Thus, use of the T-type steels represents a very small, static field of application, while the development of M-type steels is still maturing. World War II and the Korean War both accelerated acceptance of M-type steels, although unfortunate experiences in controlling the alloying and heat treating of M-type steels during World War II caused a temporary return to T-type steels immediately following the war.

In addition there was little price differential to favor the M-type steels immediately after World War II. One reason that the use of all T-types has suffered is that consumers use M-type wherever possible, reserving the use of T-types to cases where cobalt-modified or high-vanadium types are absolutely required by service conditions.

M-10 is one of the oldest of the M-type steels, having been standard for hacksaw strip since the early 1930's. In 1933, M-1 was applied to the manufacture of twist drills, but acceptance was slow because of lack of experience with new material and lack of confidence in M-type steels. As more experience was acquired, M-2 steel became dominant in the field, partly because it is the easiest to harden properly.

Early experience showed that half the amount of molybdenum could do the job formerly required of tungsten. However, an upward adjustment in carbon content of M-type steels was necessary because of the greater carbide-forming tendency of molybdenum as compared to tungsten. An advantage of the M-type steels is the lower hardening (near 2200° F.) temperatures they require as compared to T-type steels (2400° F.). M-2 has the broadest range of useful hardening temperatures; M-1 has a fairly broad range; and M-10 requires very careful control of hardening temperatures for best results.

The two best methods for heat treating molybdenum high speed steels are salt baths or atmosphere-controlled furnaces. Salt baths heat faster and can be operated about 25° F. below atmosphere furnaces. A eutectic mixture of barium-calcium-sodium salts is preferred because of lower melting temperatures and greater salt fluidity (and hence less dragout). Salt baths must be carefully operated, and if not deoxidized and desludged properly will cause loss of carbon from the steel. Borax coatings are not too desirable because of reactions between borax and furnace linings. Carbon block methods are still used for occasional heat treating of high speed steel.—**Reported by Carl A. Keyser for Springfield.**

Presents Talk on Gating Systems

W. H. Johnson, Naval Research Laboratories, Spoke on "Gating Systems for Castings", and National Secretary W. H. Eisenman Presented the Coffee Talk at a Meeting Held in Kansas City. Shown are, from left: Mr. Johnson; R. R. Griner, chairman; Mr. Eisenman; and C. G. Hummon, secretary

Speaker: W. H. Johnson

Naval Research Laboratories

W. H. Johnson, metallurgist with the Naval Research Laboratories, presented a talk on "Gating Systems for Castings" at a meeting held recently by the **Kansas City Chapter.** He accompanied his talk with excellent slides and colored motion pictures which showed the effects of different types of gating on the solidification and soundness of metals.

Mr. Johnson pointed out that the effective head of the sprue is more important than the potential head, and that at a 6 to 10-ft. sprue height the flow rate of the molten metal is fairly consistent. To cut down the erosion effects of the molten metal it is necessary to make full use of carefully designed pouring cups and pools as well as careful gate design. He also presented some theoretical conceptions which could be directly applied to foundry practice.

National Secretary W. H. Eisenman, who delivered the coffee talk, gave an interesting outline of the "A.S.M. of Tomorrow," and presented a plaque to Fred A. McCoy, chief metallurgist, Sheffield Steel Co., on behalf of the chapter for his service to the chapter and his leadership in the field of metallurgy.—**Reported by D. C. Goldberg for Kansas City.**

New Films

The Leading Role

A 25-min. standard 16-mm. black-and-white motion picture which demonstrates the advantages of the tube as a structural form, tells how welded steel tubing is made, shows uses for tubing, reveals how tubing serves our everyday life, and shows typical fabrication of tubing into an automobile rear axle housing. The film may be borrowed from the Formed Steel Tube Institute, 850 Hanna Bldg., Cleveland 15, Ohio.

Work Simplification on Film

A 12-page folder listing 38 films on the use of work simplification in industry, produced by leading American companies, may be obtained by writing the Industrial Management Society, 35 East Wacker Dr., Chicago 1, Ill.

Presents McFarland Award at Penn State

Shown (Left) Receiving a Copy of the 125-Year History of Wiremaking in America From a Former Student Is Milton S. Eisenhower, President of Pennsylvania State University. Personnally delivering the brochure is Van H. Leichliter, vice-president of operations, American Steel & Wire Division, U. S. Steel Corp., who graduated from Penn State in 1930. Mr. Leichliter returned to the campus to receive the David Ford McFarland Award, bestowed by the Penn State Chapter, for outstanding achievements in metallurgy

Speaker: Van H. Leichliter

American Steel & Wire Div.

The "Electomic Age", born of the wedding of electronic wizardry and fantastic atomic forces, promises mankind an abundant future which will far outstrip the combined achievements of the steam engine and the dynamo to date.

This was the message of Van H. Leichliter, vice-president of operations, American Steel & Wire Division, U. S. Steel Corp., who spoke on the challenge of the "Electomic Age" to America's wiremaking industry. Mr. Leichliter addressed the **Penn State Chapter** on the occasion of his being honored with the David Ford McFarland Award for outstanding achievement in metallurgy. Mr. Leichliter is the eighth recipient of the Award, instituted by the Chapter to honor Penn State alumni for achievements in metallurgy.

W. J. Reagan, chairman of the Awards Committee, presented the Certificate of Recognition to Mr. Leichliter, who was graduated from Penn State and went with American Steel & Wire 26 years ago. He progressed from a metallurgical laboratory job to vice-president of operations after holding executive posts in plants in Worcester and Cleveland, and in Cleveland headquarters.

The late David Ford McFarland, in whose name the award was established in 1949, had a distinguished career in chemistry, later turning to metallurgy, in which field he is regarded as one of the pioneers. Dr. McFarland was the co-discoverer of helium in natural gas and also devised methods for successfully extracting it. He was head of the department of metallurgy until his retirement in 1945.

In characterizing the new era ahead as the Electomic Age and weighing its effect on wiremaking, Mr. Leichliter highlighted the strong interrelationship of electronic and atomic forces.

He pointed out that complex applications of electronic devices have extended the five senses of man in the order of a million times—particularly in the field of measuring, magnifying and calculating. Giant computers can do a million mathematical computations a minute while a man with a desk calculator does but a half dozen. Radar, television, X-ray units and special light amplification devices enable him to see in the dark, through fog, and even through metal. Together this electronic equipment gives man a sensitive automatic control of highspeed machinery in manufacturing.

Atomic development not only permits him to take atoms apart and put them together in different form, but has released undreamed of energy. In addition, this research has now developed more than 800 radioactive isotopes which are being put to commercial use with amazing results.

But strangely enough, without the benefit of electronic devices, the progress of atomic development would almost come to a halt. They are inseparably entwined — almost giving the appearance of a single tool applicable on most every frontier of progress.

Because atomic rays have exhibited the ability to change the properties in metals and achieve transmutation, Mr. Leichliter suggested that steel wiremaking may be radically changed and its properties—including strength, corrosion resistance and electrical conductivity—may be appreciably enhanced by atomic irradiation applications yet to be discovered.

He also pointed out that today wire for suspension bridges has tensile strength up to 250,000 psi., that recently high-carbon wire has been drawn with a strength of 500,000 psi., and that a pure iron crystal of 1,000,000 psi. has recently been created in a laboratory.

Viewing this progress, Mr. Leichliter suggested that vastly improved refining processes will provide the new highs in strength and other properties in metals. Of course, electronic devices, electric power and other atomic phenomena will be on hand to aid in these accomplishments.

This year being the 125th anniversary of the first successful drawing of wire in America, Mr. Leichliter reviewed wire development since 1831. The first wire was drawn in Worcester, Mass., from cast steel and had a tensile strength of but 60,000 lb. Today, he said, American Steel and Wire stocks 600 different types of steel billets for wiremaking. About 15,000 practices have been developed in the course of turning out 160,000 kinds of wire and wire products ranging from nails to barbed wire fence, from spring wire for watches to oil well cables more than five miles long.

In referring to the importance of the metallurgist in the Electomic Age, Mr. Leichliter said that history has made it clear that in our complex world of knowledge and invention and development, each of us has value in direct proportion to our ability to appreciate and work with the over-all team. In this team concept, he visualized the metallurgist as the quarterback, by reason of the fact that he stands astride the raw material of the metals of the earth.

A.S.M. prepares and distributes on request, preprints of the technical and scientific articles presented at the annual convention.

Speaks on Vacuum Melting Techniques in New York

Speaker: F. N. Darmara

Utica Drop Forge & Tool Corp.

At a meeting of the **New York Chapter,** Falih N. Darmara, vice-president and manager, Metals Division, Utica Drop Forge & Tool Corp., spoke on "Vacuum Melting".

Dr. Darmara explained his company's four years' experience in the production vacuum melting of high-temperature alloys, covering facilities employed, metals handled, production rates, and improved properties of metals produced by vacuum melting techniques. He also reviewed some of the theoretical bases upon which the improvement of properties attendant upon use of vacuum melting techniques might depend.

Through the use of slides, Dr. Darmara illustrated five melting furnaces, ranging in capacity from 10 to 1000 lb., which enable Utica Drop Forge to maintain a production rate of over 100,000 lb. per month. He discussed the maintenance problems connected with the furnaces, making it clear that the vacuum melting process places great demands on refractories and other components of the furnace systems. The extensive control facilities maintained, by way of spectrographic, chemical, metallurgical and creep test equipment, were mentioned, such equipment being necessary not only in the extensive research carried on, but also in producing high-quality metals.

Some time was devoted to a discussion of the improvement in properties of metals melted by vacuum processes. It was pointed out that stress rupture life could be increased up to five times, and that notch sensitivity was radically decreased. Indeed, the latter property is so much improved that the practice of notch testing may be discontinued. Possible reasons for such exceptional improvements in properties were mentioned.

Dr. Darmara suggested that close chemical control, absence of gases, absence of refractory oxides and nitrides and boiling off of low melting point elements might account for such improvements.

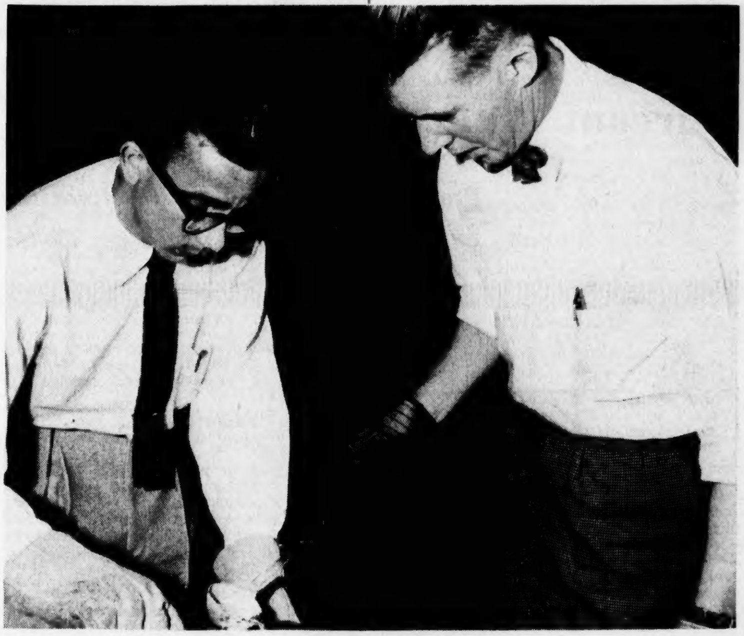
The reason why the scientific rationale of the improvement in properties could not be set forth with greater precision is the absence of analytical methods which are accurate within the ranges necessary for vacuum melted metals.

The importance of deoxidation in vacuum melting was discussed, as well as the behavior of elements that are deoxidized, even under normal melting conditions, when such elements are present during vacuum melting.

Dr. Daramara closed by reviewing the future of vacuum melting as he sees it, with mention of the fields in which vacuum melting should prove valuable. Previous success in developing new alloys, such as Udimet-500, by vacuum melting, gives hope that in the future other new materials will appear under the impetus of vacuum melting research.

This same meeting was a very important one as it marked the presentation by the New York Chapter of its first Chapter Award, a handsome medal, to an outstanding member of the New York metallurgical community. The Chapter hopes to set the award up on an annual basis. As the first recipient, Howard S. Avery, research metallurgist, American Brake Shoe Co., Mahwah, N. J., was selected. In making the presentation, John Nielsen, chairman of the New York Chapter, recounted Mr. Avery's outstanding career, not only in the field of metallurgy, but also in the community at large.—**Reported by Burton Perlman for New York.**

Exhibit at U. of C.'s Golden Anniversary



William Tholke (A.S.M.), University of Cincinnati Instructor, Pours Steel Into a Shell Mold in the Metallurgical Engineering Laboratory Exhibit During the University's 50th Anniversary Observance of Co-Operative Education. Jim Myers, metallurgical engineering student is his assistant

At the request of Walter C. Langsam, president of the University of Cincinnati, National President Adolph O. Schaefer, director of research, Midvale-Heppenstall Co., was invited to represent the American Society for Metals and the metallurgical profession at the Golden Anniversary of Co-Operative Education at the University. The observance opened with a Co-Op Day, which featured educational exhibits in the classrooms and laboratories, and several conferences and technical talks.

Mervin J. Kelly, president of Bell Telephone Laboratories, predicted that there will be machines which talk to machines in the same manner that people now talk to each other by telephone, in a discussion of "America's Future Scientists, Engineers and Managers".

He also predicted that when automation reaches its full development in the next few decades, it will be possible to interconnect widely separated automation systems over the nation's communications systems. Then, by means of an electronically transmitted digital language, automation systems of commerce, business and industry can be integrated and controlled from one source. Dr. Kelly said that we do not have to fear automation. He asserted it would be beneficial economically and socially and is a growing economic and social force whose significance may be larger than that of mechanization.

Neil H. McElroy, president, Procter & Gamble Co., called for more vision by leaders in education and industry. He said that although we can see where our predecessors erred on the side of caution as they looked to the present, there is a tendency now to do the same thing in looking toward the future.

Laurence C. Hart, vice-president of Johns-Manville Corp., speaking on the responsibilities of leadership, said that mere vocational training and academic education are not adequate to meet the requirements of our challenge. Infiltration of certain foreign, and unfortunately, some domestic, ideologies, broadens the responsibilities which must be assumed by business, industrial and educational leadership.

A.S.M. Review of Current Metal Literature

An Annotated Survey of Engineering, Scientific and Industrial Journals and Books Here and Abroad Received During the Past Month

Prepared by the Technical Information Division of Battelle Memorial Institute, Columbus, Ohio

A General Metallurgical

170-A. Standard Operating Procedure for Thorium Chip Processing. E. W. Mautz, O. R. Magoteaux, P. Kleinsmith and W. B. Clymer. *U S. Atomic Energy Commission, Research and Development Report,* FMPC-164 (Rev. 1), Jan. 1954, 9 p.
Procedure for grinding, pickling and drying chips for briquetting. (A8, B17, Th)

171-A. Solid State Physics Quarterly Progress Report April-June, 1955. Dwain Bowen. *North American Aviation, Inc. (U. S. Atomic Energy Commission),* NAA-SR-1452, Mar. 1956, 35 p.
Material covers radiation damage to graphite, low-temperature annealing studies of graphite, cold work, radiation damage, mechanical properties of thorium, displacement energy in nickel, activation energies. Graphs. 21 ref. (A general, Th)

172-A. World Steel Production. Eric Ford. *British Steelmaker,* v. 22, Apr. 1956, p. 100-102.
An over-all survey of economic factors. Tables. (A4, ST)

173-A. X-Ray and Gamma-Ray Safety Precautions. *British Welding Journal,* v. 3, Apr. 1956, p. 143-148.
Essential precautions to safeguard personnel from injurious effects of radiations from X and gamma-ray sources. Diagrams, graphs. 4 ref. (A7, S13)

174-A. Pig-Iron and Steel Production. *Foundry Trade Journal,* v. 100, Apr. 12, 1956, p. 185.
Statistical summary of December 1955 returns. (A4, Fe, ST)

175-A. Don't Throw $$$ Away in the Furnace. Harold W. Lownie, Jr. *Modern Castings,* v. 29, May 1956, p. 147-152.
Factors affecting pig and scrap prices; ways to reduce foundry costs; theories on heredity in pig iron. (A4, E10, CI)

176-A. Electrolytic Recovery of Zinc From Galvanizers' Sal Skimmings. P. M. Sullivan. *U. S. Bureau of Mines, Report of Investigations* 5205, Mar. 1956, 21 p.
New application of electro-amalgam metallurgy in recovering all the zinc as refined metal from galvanizers' sal skimmings. Diagrams, photographs, tables. 37 ref. (A8, Zn)

177-A. Statistical Approach to R & D Problems. R. L. Brickley and W. H. Horton. *Electrical Manufacturing,* v. 57, May, 1956, p. 88-94, 362.
Wedding of statistics and engineering aimed at reducing the cost, easing the monotony and improving the validity of research and development testing through scientific design of experiments. Tables. (A4, A9)

178-A. Export Market Potentials. *Metal Industry,* v. 88, Apr. 20, 1956, p. 305-313.
Outlines of needs, world economy and purchasing habits of people. Factors for countries where British manufacturers in the nonferrous and allied industries are likely to find openings. Photographs, tables. 12 ref. (A4)

179-A. Metals. E. M. Sherwood. Paper from "High-Temperature Technology". John Wiley & Sons. p. 17-28.
Metallic materials discussed on the basis of melting point, vapor pressure, high-temperature mechanical properties, relative cost and availability. Tables. 12 ref.
(A general, P12, Q general)

180-A. (Czech.) **The Effect of Production Equipment on Casting Costs.** Miroslav Bednarik. *Slévarenstvi,* v. 4, no. 3, Mar. 1956, p. 65-68.
Wage and equipment costs for manufacture of soil-pipe castings. Graphs, tables. (A4, E general, CI)

181-A. (French.) **Metallurgical Factors in the Manufacturing Price of Thin Pieces of Gray Cast Iron.** Etienne Doat. *Fonderie,* 1956, no. 122, Mar. 1956, p. 107-111.
Chemical compositions best adapted to production of thin pieces. Cost considerations based on various production factors. Tables. 8 ref. (A4, E general, CI)

182-A. (German.) **Automatic Equipment in Galvanizing Shops.** K. Gebauer. *Metalloberfläche,* v. 10, no. 4, Apr. 1956, p. 98-103.
Development and methods of operation of transportation systems and other automatic equipment.
(A5, L16, Zn)

183-A. (Book.) **High-Temperature Technology.** I. E. Campbell, editor. 526 p. 1956. John Wiley & Sons, 440 4th Ave., New York 16, N. Y. $15.00.
Summarizes recent developments and indicates importance of established techniques and materials to modern high-temperature technology. Individual papers abstracted separately. (A general)

184-A. (Book.) **The Non-Ferrous Metal Industry in Europe.** 92 p. 1956, Organization for European Economic Co-Operation, 2, rue André-Pascal, Paris, France.
Report covers period of 1954 and first half of 1955. Aluminum, copper, lead, zinc, tin and nickel are considered with respect to consumption, exports, stocks, production and imports. (A4, Al, Cu, Pb, Zn, Sn, Ni)

185-A. (Book.) **Proceedings of the International Conference on the Peaceful Uses of Atomic Energy. Nuclear Chemistry and Effects of Irradiation,** v. VII, 691 p., 1956. United Nations, New York. $10.00.
Papers cover fission processes and products, facilities for handling highly radio-active materials, chemistry of transuranics, methods and chemistry of separating heavy elements, effects of radiation on reactor materials, liquids and solids.
(A general)

The coding symbols at the end of the abstracts refer to the ASM-SLA Metallurgical Literature Classification. For details write to the American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio.

B Raw Materials and Ore Preparation

102-B. Refractories. V. O. P. Nicholson. *Metal Industry,* v. 88, Mar. 30, 1956, p. 245-248.
Phase relationships studied. Table, phase diagrams. 9 ref. (B19)

103-B. Design and Evaluation—Turbine Mixers in Metallurgical Applications. N. H. Parker, G. Gutzeit and J. G. Papailias. *Mining Engineering,* v. 8, Mar. 1956, p. 288-292.
Various applications in extractive metallurgy. Diagrams, graphs, table. (B14, C general)

104-B. Flotation and Leaching of Products From High Lime Utex Ores. D. R. George and Robert A. Eisenhauer. *National Lead Co., Inc., Raw Materials Development Laboratory (U. S. Atomic Energy Commission),* WIN-2, Dec. 1954, 45 p.
Test data on the flotation of calcite from high lime Utex ores and on leaching of the products with sulfuric acid or sodium carbonate solutions. Tables. (B14, U)

105-B. Initial Operation of New Acid Leach Resin-in-Pulp Pilot Plant. C. K. McArthur, T. F. Izzo and R. L. Shimmin. *National Lead Company, Inc., Raw Materials Development Laboratory (U. S. Atomic Energy Commission),* WIN-17, July 1955, 28 p.
Fourteen-bank system proved practical in operation and highly efficient for uranium recovery from desanded ore pulps. Tables, diagrams. (B14, U)

106-B. Preparation of Pure Zirconium Oxide; Laboratory Studies. W. R. Grimes, C. J. Barton, Sr.,

L. G. Overholser, J. P. Blakely and J. D. Redman. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission)*, Y-560, Feb. 1950, 64 p.

Recent improvements in the thiocyanate process for hafnium extraction; methods for purification of hafnium-free zirconium. Tables. 8 ref. (B14, Zr)

107-B. Hafnium Metal. I. Conversion of Hafnium Oxide to Hafnium Tetrafluoride. Joe L. Williams and Boyd Weaver. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission)*, Y-644, Aug. 1950, 11 p.

Anhydrous hafnium tetrafluoride, free from significant amounts of oxygen and other impurities, was prepared by hydrofluorination of ignited hafnium oxide, followed by vacuum sublimation. Table, photograph, diagrams. 7 ref. (B14, Hf)

108-B. (English.) **Theoretical Studies on Magnetic Separation. I. Magnetic Forces of Mineral Particles and the Sensitivity of Magnetic Separation.** Saburo Yashima. *Technology Reports, Tohoku University*, v. 20, no. 1, 1955, p. 143-164.

The fundamental equation of magnetic force affecting a mineral particle under given field conditions; application to particles of uniform composition and to rocked particles. Diagrams, graphs, tables. 11 ref. (B14)

109-B. The Roasting of Pitchblende Ore. O. J. Buckheim, H. C. Kloepper, R. M. Paine, A. E. Ruehle, J. W. Stevenson and L. G. Weber. *U. S. Atomic Energy Commission Research and Development Report*, NYO-1315, Dec. 1950, 11 p.

Effect of air and steam roasting on the sulfur content, uranium recovery, acid consumption and filtration rate of several ores, including those of both high and low initial sulfur content. Tables, graphs. (B15, U)

110-B. Physical Chemistry of the Krupp-Renn Process. H. Weidermann. *Henry Brutcher Translation No.* 3486, 21 p. (From *Metallurgie und Giessereitechnik*, v. 4, no. 11, 1954, p. 462-468.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 38-B, 1955. (B16, Fe)

111-B. New Process of Pouring Ferrosilicons. Ya. V. Dashevskii, A. E. Runov, I. S. Kazak, D. D. Zheltov and B. A. Mel'nik. *Henry Brutcher Translation No.* 3636, 16 p. (From *Stal*, v. 15, no. 8, 1955, p. 714-719.) Henry Brutcher, Altadena, Calif.

A new generally adaptable method of producing clean and stable 45 and 75% ferrosilicon slabs which eliminates dressing of the ingots. Tables, graphs, diagrams. 10 ref. (B22, D9, Fe, Si)

112-B. (English.) **Studies on the Separation of the Rare Earths and Their Accompanying Elements. X. A New Quantitative Precipitation of Thorium and Rare Earths From a Homogeneous Solution, and Its Application for the Extraction of Some Elements From Ores. XI. Absorption Spectra of Light Lanthanons and Thorium in Ultraviolet and Visible Range From the Viewpoints of Their Determinations.** Zenzi Hagiwara. *Technology Reports, Tohoku University*, v. 20, no. 1, 1955, p. 77-108.

A proposed scheme of extraction of rare earths and thorium from a monazite sand. Absorption spectra measured as a guide to the efficiency of separation. Tables, graphs, photograph, diagram. 25 ref. (B14, S11, EG-g, La, Th)

113-B. (English.) **The Phase $CaO \cdot Fe_2O_3$ in the System $CaO-Fe_2O_3$, and Its Importance as Binder in Ore Pellets.** John Olof Eström. *Jernkontorets Annaler*, v. 140, no. 2, 1956, p. 101-113.

The phase diagram was revised in its ferric oxide-rich portions. The above phase is stable at temperatures used in pellet production. Addition of calcium oxide raises crushing strength of pellets. Graphs, diagram, tables, micrographs. (B16, M24, Fe)

114-B. (Russian.) **The Chemical Theory of Slag Structure.** V. A. Kozheurov. *Zhurnal Fizicheskoi Khimii*, v. 30, no. 2, Feb. 1956, p. 295-304.

Comparison of results of calculating the activities of binary and ternary solutions according to the chemical theory of melts to the theory of regular solutions (zero approximation), and to formulas obtained on consideration of short range order (first approximation). Graphs, tables. 10 ref. (B21)

115-B. The Eldorado Gravity Plant, Port Radium, N. W. T. R. L. Behan. *Canadian Mining & Metallurgical Bulletin*, v. 49, No. 528, Apr. 1956, p. 254-261.

Developments of methods of treatment of uranium ores. Details of present flow-sheet and a tailings reclamation program now being carried out. Diagrams, photographs. 3 ref. (B14, U)

116-B. Leaching of Uranium From Gravity Mill Tailings At Port Radium, N. W. T. D. F. Lillie and R. Tremblay. *Canadian Mining & Metallurgical Bulletin*, v. 49, no. 528, Apr. 1956, p. 262-273.

Chemical processes employed in recovering uranium remaining in gravity plant tailings. Plant is designed to handle 300 tons per day. Diagram, photographs, tables. 3 ref. (B14, U)

117-B. Solid Fuels and the Dwight-Lloyd Sintering Process. Harold E. Rowen. *Mining Engineering*, v. 8, Apr. 1956, p. 396-398.

Sintering mechanisms explained on the basis of combustion of solid fuel with 90 to 95% ash content. Diagrams, photographs. (B16)

C — Nonferrous Extraction and Refining

144-C. The Extraction of Uranium From Sodium Nitrate Solutions With Dibutyl Carbitol. J. M. Googin and T. P. Sprague. *Carbide and Carbon Chemicals Corporation (U. S. Atomic Energy Commission)*, Y-331, Jan. 1949, 17 p.

Extraction of uranyl nitrate fom sodium nitrate-nitric acid solutions with dibutyl carbitol gives a maximum distribution coefficient of about 17 (org./aq.). The value of 17 was obtained with 7.2 *N* sodium nitrate and 0.4 *N* nitric acid. Graphs, tables. (C general, U)

145-C. Separation of Hafnium From Zirconium by Extraction of Thiocyanate Complexes. L. G. Overholser, C. J. Barton and W. R. Grimes. *Carbide and Carbon Chemicals Corporation, (U. S. Atomic Energy Commission)*, Y-431, June, 1949, 23 p.

Report on the progress to date of attempted separation of hafnium from zirconium by the difference in ether extractibility. Method shows considerable promise due to its rapid equilibrium time, its high separation factor, and the availability of the reagents involved. Graphs, tables. 1 ref. (C28, Hf, Zr)

146-C. Sodium-Aluminum Equilibria in Cryolite-Alumina Melts. Morris Feinleib and Bernard Porter. *Electrochemical Society, Journal*, v. 103, Apr. 1956, p. 231-236.

Studies at 940 to 1010° C. were undertaken to shed more light on the cathode reactions in the aluminum cell. Tables. 26 ref. (C23, Al)

147-C. Tantalum. Chester Placek and Donald F. Taylor. *Industrial and Engineering Chemistry*, v. 48, Apr. 1956, p. 686-695.

Step-by-step processing from hydroxide fusion of ore through leaching, hydrofluoric acid dissolution, crystallization, electrolysis, pressing of powder and sintering to the massive metal. Table, graph, photographs, flowsheet. 30 ref. (C23, Ta)

148-C. Refining of Platinum and Rhodium by an Ion Exchange Process. Charles K. Butler. *Industrial and Engineering Chemistry*, v. 48, Apr. 1956, p. 711-713.

Employs a cation exchange technique for the near-quantitative separation of base metal contaminants from anionic complexes of platinum and rhodium; adsorption of cations is dependent on the free acid in the influent. A platinum-rhodium alloy containing 4% base metals was refined to 99.98% precious metals. Diagram, photograph. 4 ref. (C general, Pt, Rh)

149-C. The Production of Uranium by the Reduction of UF_4 by Mg. F. H. Spedding, H. A. Wilhelm and W. H. Keller. *Iowa State College, Ames Laboratory (U. S. Atomic Energy Commission)*, CT-2712, June 1945, 67 p.

Experimental procedures; production of UF_4; processing and specifications of UF_4, Mg and linear refractories; conditions of operation; properties of metal produced. Graphs, tables, diagram. 41 ref. (C4, U)

150-C. Vacuum-Melting Nickel-Base Alloys on a Production Scale. F. N. Darmara and J. S. Huntington. *Mechanical Engineering*, v. 78, Apr. 1956, p. 323-326.

Vacuum manufacture of Waspaloy to pass a 40 hr. creep test of 32,-500 psi. at 1500° F. Table, graphs, photographs, diagram. (C25, Ni)

151-C. The Mains Frequency Coreless Induction Melting Furnaces. Considerations Affecting Design. *Metallurgia*, v. 53, no. 317, Mar. 1956, p. 99-102.

Design, characteristics and applications of large induction furnaces. Diagrams, photographs. (C21, D6)

152-C. The Extraction and Purification of Titanium. Graham Oldham. *Mining Journal*, v. 246, Mar. 30, 1956, p. 391-393.

Review of recent progress. Patented reduction processes discussed. Photographs. 19 ref. (C general, Ti)

153-C. Hafnium Metal. II. Reduction of Hafnium Tetrafluoride to Hafnium Metal. P. J. Hagelston, R. O. Hutchison and F. J. Lambert. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission)*, Y-645, Aug. 30, 1950, 10 p.

Reduction process using calcium and iodine as the reductant and heat booster, respectively. Diagram, photographs, table. (C4, Hf)

154-C. The Separation and Collection of U-236 by the Electromagnetic Process. H. W. Savage and P. E. Wilkinson. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission)*, Y-697, Nov. 1950, 136 p.

A 12-in. radius, high-recovery calutron was designed, tested, and used.

Details of the experimental, design, calutron operations, chemistry, mass analysis and health physics programs. Tables, photographs, diagrams, graphs. 14 ref.
(C general, U)

155-C. Recovery of Uranium by Ion Exchange Resins. Sallie Fisher and Frank McGarvey. *Rohm and Haas Company, Research Laboratories (U. S. Atomic Energy Commission),* RMO-2518, Mar. 1953, 34 p.

Selection of optimum-porosity resin; chemistry and hydraulics of resin operation; recovery of uranium in eluate. Diagram, tables, graphs. (C general, U)

156-C. Separation of Hafnium From Zirconium by Multiple Recrystallization of Ammonium Fluozirconates. Wallace W. Beaver. *U. S. Atomic Energy Commission, Research and Development Report,* BBC-54, Aug. 1950, 85 p.

A process for separating zirconium and hafnium by recrystallization of ammonium zirconium fluoride; projection of this process into a plant scale development in an attempt to produce 10,000 lb. of zirconium content as pure zirconium oxide. Tables, diagrams, graphs, photographs. (C28, Zr, Hf)

157-C. An Investigation of Methods for the Separation of Uranium Contained in Uranium Bearing Ore Concentrates From Western Colorado. G. C. Reid. *U. S. Atomic Energy Commission, Research and Development Report,* MCW-8, Apr. 1946, 16 p.

A process using carnotite concentrates was found to give clean separation and high recovery. Tables.
(C general, B14, U)

158-C. Reduction of Uranyl Fluoride With Hydrogen. O. J. Buckheim, C. F. Ritchie, C. D. Harrington and C. W. Kuhlman. *U. S. Atomic Energy Commission, Research and Development Report,* MCW-175, Mar. 1949, 7 p.

Experimental process, reaction rate and reaction mechanism. Graph, tables. 4 ref. (C4, U)

159-C. Homogeneous Alloy Ingots Produced by Consumable-Electrode Arc Melting. R. A. Beall, F. Caputo and E. T. Hayes. *U. S. Bureau of Mines, Report of Investigations,* 5200, Mar. 1956, 12 p.

Various methods used to introduce alloying materials into the homogeneous zirconium-alloy ingot evaluated by the degree of homogeneity of resulting ingots, as determined in tests on sections cut from the ingots. Tables, photographs. 3 ref.
(C21, Zn)

160-C. The Extraction Mechanism of Plutonium (IV) TTA Chelate in Sec-Butylbenzene-Nitric Acid-Uranyl Nitrate Mixtures. D. L. Heisig and T. E. Hicks. *University of California Radiation Laboratory (U. S. Atomic Energy Commission),* UCRL-1169, July 1952, 75 p.

Rate of extraction, both with and without uranyl nitrate, was found to be limited by the rate of transfer of plutonium across the organic-aqueous boundary layer. Graphs, tables. 21 ref. (C general, Pu)

161-C. Investigation of Equilibrium in the Reduction of Titanium Dioxide by Carbon at High Temperatures. I. V. S. Kutsev and B. F. Ormont. *Henry Brutcher Translation No.* 3642, 10 p. (From *Zhurnal Fiz. Khimii,* v. 29, no. 4, 1955, p. 597-601.) Henry Brutcher, Altadena, Calif.

Chemical and X-ray analysis; equilibrium by carbon monoxide pressure from 1600 to 2000° K.; stability of TiO1.7. Table. 14 ref.
(C general, Ti)

162-C. Measurements of Velocity of Flow in Liquid Metal in Induction Furnaces. M. Riepe and H. Ilberg. *Henry Brutcher Translation No.* 3653, 12 p. (Abridged from *Forschung auf dem Gebiete des Ingenieurwesens,* v. 2, no. 11, 1931, p. 1-7.) Henry Brutcher, Altadena, Calif.

Investigates forces and pattern of metal flow in the melting channels of induction furnaces. Causes of circulation of liquid metal in channel. Graphs, diagrams. 2 ref.
(C21, D6)

163-C. Production of Boron by Igneous Electrolysis. J. L. Andrieux and W. J. Deiss. *Henry Brutcher Translation No.* 3659, 8 p. (Abridged from *Bulletin de la Société Chimique de France,* no. 6, June 1955, p. 838-841.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 116-C, 1955. (C23, B)

164-C. Solvent Extraction of Zirconium With Tributyl Phosphate. Arnold E. Levitt and Harry Freund. *American Chemical Society, Journal,* v. 78, Apr. 20, 1956, p. 1545-1549.

Study of variables involved in extraction from hydrochloric acid solutions. Graphs, tables. 25 ref.
(C general, Zr)

165-C. Solvent Extraction Problems Overcome. *Chemical Engineering,* v. 63, May 1956, p. 130-132.

Uranium is removed from wet-process phosphoric acid by solvent extraction, followed by precipitation. Extraction is by violent agitation of the phosphoric acid and solvent in tanks, followed by separation in centrifuges. Photographs, diagram. (C general, U)

166-C. Tantalum Process Operations Line-Up. *Chemical Week,* v. 78, Apr. 28, 1956, p. 62, 64, 66.

Use of liquid-liquid extraction to separate tantalum and columbium salts for electrolysis.
(C general, Ta, Cb)

167-C. Continuous Casting of Non-Ferrous Strip. *Steel Processing,* v. 42, Apr. 1956, p. 212-213, 238.

Method is one of several which have been used with varying commercial success; it is particularly designed for strip rather than rounds or squares. Photographs. (C5)

168-C. Zirconium Purification, Using a Basic Sulfate Precipitation. R. H. Nielsen and R. L. Govro. *U. S. Bureau of Mines, Report of Investigations* 5214, Mar. 1956, 14 p.

Technical-grade sulfuric acid is used to precipitate a basic zirconium sulfate from a hot dilute hydrochloric acid solution. With close control of temperature, pH, and zirconium-sulfate ratio, excellent purification and complete zirconium recovery can be attained. Diagrams, graphs, tables. 17 ref.
(C general, Zr)

169-C. Experimental Electric Smelting of Manganese Ores. R. A. Campbell, G. E. Viens and R. R. Rogers. *Canadian Mining & Metallurgical Bulletin,* v. 49, no. 528, Apr. 1956, p. 274-280.

Electric smelting of five low-grade Canadian manganese ores investigated. In one case, results were considered to be sufficiently promising to justify the construction of a pilot plant. Graph, tables. (C21, Mn)

170-C. The Separation of Polonium From Bismuth by Distillation. R. W. Endebrock and P. M. Engle. *Monsanto Chemical Company, Mound Laboratory (U. S. Atomic Energy Commission),* AECD-4146, Aug. 1953, 43 p.

Experimental work on the separation of polonium from bismuth by distillation during the period from 1949 to 1952. Data showing operation of simple batch stills and of fractionating stills with and without helium sparging. The problem of materials of construction and data obtained while working on this phase of the project. Diagrams, graphs, tables. 24 ref. (C22, Bi, Po)

171-C. Production of Uranium Metal by the Hot Wire Technique. G. Derge, M. Fine, G. Monet, I. Rehn and A. Rodrigues. *University of Chicago, Metallurgical Laboratory (U. S. Atomic Energy Commission),* AECD-3697, Oct. 1944, 29 p.

Hydrogen and iodine were passed over crude uranium at 500° C. to form uranium tetra-iodide which decomposed on a thorium oxide coated tungsten filament operating at 1500° C. The pure uranium dripped into a crucible in the cooler part of the furnace. This produced spectroscopically pure metal and alternative designs were made to simplify operation and extend it to larger scales. Diagrams, graphs, micrographs, tables. 17 ref. (C4, U)

172-C. (French.) The Ultimate Purification of Metals by Physical Methods. F. Montariol. *Chimie & Industrie,* v. 75, no. 1, Jan. 1956, p. 57-64.

Principles of method for purifying metals by moving a molten area along a bar; calculations by means of which the distribution of impurities in an ingot after such a treatment may be predicted; various applications, technical problems involved and results obtained. Diagrams, graphs, photograph, table. 13 ref. (C5)

173-C. (German.) **Present State of Industrial Vacuum Smelting Process.** Otto Winkler. *Zeitschrift für Metallkunde,* v. 47, no. 3, Mar. 1956, p. 133-144.

Effects which may be achieved by vacuum treatment of melts. Present fields of application, methods and future trends. Diagrams, graphs, photographs. 23 ref. (C25, D8)

174-C. (German.) **Manganese Losses During Smelting of Nickel-Manganese Alloys Under Low Pressure.** Lore Schumann-Horn, Albrecht Mager and Walter Deisinger. *Zeitschrift für Metallkunde,* v. 47, no. 3, Mar. 1956, p. 145-148.

Studies during melting in a vacuum. The loss of manganese is exclusively due to evaporation, this process being subject to an exponential time law with a time constant which is independent from the manganese content but dependent on pressure and temperature. Tables, graphs. 6 ref. (C25, Ni, Mn)

175-C. (German.) **Titanium and Zirconium Smelting in Vacuum Electric Arc Furnace.** Helmut Gruber and Helmut Scheidig. *Zeitschrift für Metallkunde,* v. 47, no. 3, Mar. 1956, p. 149-160.

Experience with a furnace provided with bar feed for controlling a melting electrode (maximum weight of charge, 300 kgs.) Diagrams, photographs, graphs, tables. 33 ref. (C25, Ti, Zr)

176-C. (German.) **High Vacuum Arc Smelting of Molybdenum.** Richard Kieffer and Friedrich Benesovsky. *Zeitschrift für Metallkunde,* v. 47, no. 3, Mar. 1956, p. 160-164.

Design and operation of melting furnaces for production of ingots of substantial size. Tables, graphs, micrographs, diagrams, photograph. 19 ref. (C25, Mo)

177-C. (German.) **Stability of Vertical Smelting Zones.** W. Heywang. *Zeitschrift fur Naturforschung,* v. 11a, no. 3, Mar. 1956, p. 238-243.

Theoretical investigation, determination of smelting zone surface

shape. Graphs, diagrams. 4 ref. (C21)

178-C. (Italian.) **Zinc Smelting Furnaces.** Turno De Michelis. *Fonderia,* v. 5, no. 3, Mar. 1956, p. 137 + 6 pages.

Smelting operations at the Montevecchio Co. in Italy. Diagrams. (C21, A5, Zn)

179-C. (Book.) **Bibliography on Extractive Metallurgy of Nickel and Cobalt.** R. E. Bauder. 621 p. 1956. Bureau of Mines, Washington, D. C.

Research report on utilization of Cuban lateritic ores and the chemistry of reactions of nickel and cobalt in field of extractive metallurgy. The period is from January 1929 to July 1955 and includes techniques and plant equipment for the recovery of nickel and cobalt. (C general, Ni, Co)

D

Ferrous Reduction and Refining

166-D. Fifty Years of Progress in Electric Furnace Steelmaking. Howard J. Stagg. *Metal Progress,* v. 69, Apr. 1956, p. 49-54.

Fifty years ago the first electric arc steelmaking furnace in America started production of toolsteels in competition with crucible furnaces. It has since made the crucible method obsolete and now, in many instances, produces steel at lower cost than openhearth furnaces. Photographs, tables. (D5, TS, AY)

167-D. Fifty Years of Progress in Arc-Furnace Electrodes. F. B. O'Mara. *Metal Progress,* v. 69, Apr. 1956, p. 81-88.

Arc-furnace steelmaking would be impossible without carbon and graphite electrodes. At each stage of advance in furnace design, electrodes of the necessary size and quality have been available. Photographs. 6 ref. (D5, C)

168-D. Bismuth Additions to Steel. (Digest of "Experiment of Adding Metallic Bismuth to Liquid Steel", by V. S. Bozhko; *Trudy Instituta Chernoi Metalurgii",* v. 7, 1953, p. 54-56.) *Metal Progress,* v. 69, Apr. 1956, p. 132.

The effect of additions of granular bismuth studied both in the laboratory and in commercial practice. There was no significant effect of bismuth additions on the properties of the final steel bars, and it was impossible to find any trace of residual bismuth in the steel, even with a spectroscope. (D8, Q general, ST, Bi)

169-D. Electrics Move Ahead. *Steel,* v. 138, Apr. 9, 1956, p. 120, 122-123, 125.

Reviews electric steel production and future expansion. Graph, photographs. (D5, ST)

170-D. Sulzer Axial Blowers for Furnace Blast. E. Aguet. *Sulzer Technical Review,* v. 37, no. 3, 1955, p. 1-18.

Excellent efficiency, high reliability in service and marked adaptability of the Sulzer axial blower leads the field of regulation, where new solutions are found to the problems raised by various types of drive. Diagrams, graph, photographs. (D1)

171-D. Nation's Largest Vacuum Melting Furnace. James H. Moore. *Western Machinery and Steel World,* v. 47, Apr. 1956, p. 126-128.

A new high-vacuum induction melting furnace, its operation, benefits and applications. Diagram, photographs. 3 ref. (D8, C25)

172-D. High Percent Ferrosilicon of Increased Stability. T. P. Khazanova and Yu. P. Vasin. *Henry Brutcher Translation No.* 3637, 14 p. (From *Stal,* v. 15, no. 8, 1955, p. 720-727.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 333-D, 1955. (D9, F29, Fe)

173-D. Production-Scale Trials of Large All-Basic Open-Hearth Furnaces. V. O. Kulikov, I. I. Bornatskii and A. P. Yargin. *Henry Brutcher Translation No.* 3643, 12 p. (From *Stal,* v. 15, no. 9, 1955, p. 801-806.) Henry Brutcher, Altadena, Calif.

Data on the results obtained by a change from silica to basic (chrome-magnesite) roofs in 390-net ton openhearth furnaces over several campaigns. Tables, photographs. 2 ref. (D2, ST)

174-D. Ore Versus Mill Scale for Elimination of Carbon From Steel Baths. E. Plettinger. *Henry Brutcher Translation No.* 3664, 12 p. (From *Radex Rundschau,* no. 3-4, 1955, p. 409-417.) Henry Brutcher, Altadena, Calif.

Comparative study of effects of additions of ore and mill scale to the slag in openhearth and arc furnaces to promote carbon elimination. Erroneous assumptions currently held in regard to physicochemical relationship between reaction of carbon and the oxides of iron and manganese. (D2, D5, ST)

175-D. Phase Transformations in Blast Furnaces. I. P. Bardin, A. V. Rudneva and L. M. Tsylev. *Henry Brutcher Translation No.* 3671, 8 p. (From *Izvestiya Akademii Nauk SSSR, OTN,* no. 5, 1955, p. 123-128.) Henry Brutcher, Altadena, Calif.

Study of the successive transformations and state of aggregation of the burden materials in a blast furnace, of the conditions under which slag is formed and of the phase composition of the primary slag along the furnace height for basic iron, ferrosilicon, and ferromanganese. Diagrams. (D1, Fe)

176-D. (Czech.) **On Carburization of Liquid Steel With Coke in the Ladle.** Lubomir Smrha. *Hutnické Listy,* v. 11, no. 3, Mar. 1956, p. 143-148.

Influence of carburizing steel with coke in the ladle on quality and yield of steel. The gas content of the metal was roughly proportional to the degree of carburization. Tables, photographs. 17 ref. (D9, CN)

177-D. (Czech.) **Production of Iron With Reduced Manganese Content.** Antonin Bichler. *Hutnické Listy,* v. 11, no. 3, Mar. 1956, p. 143-148.

Production of low-manganese pig iron results in savings in coke consumption and economics in making the finished steel. (D1, D2, Fe)

178-D. (German.) **Effect of Oxygen Addition to Air Blast on Gradation of Grain Sizes in Thomas Converter and Electric Arc Furnace Exhaust Gases.** Robert Meldau and Diethelm Laufhütte. *Archiv für das Eisenhüttenwesen,* v. 27, no. 3, Mar. 1956, p. 149-152.

Grain size and distribution, amount of brown smoke, sampling, comparison of normal and oxygen melts, types of iron oxides. Tables, micrographs. 9 ref. (D3, D5, ST)

179-D. (German.) **The Development of the Low-Shaft Blast Furnace Process in the German Democratic Republic.** K. Säuberlich. *Neue Hütte,* v. 1, no. 4, Feb. 1956, p. 193-201.

Application of the low-shaft blast furnace process in Germany. Metallurgical and operating characteristics; further refinements. Tables, diagram, photographs. 2 ref. (D1, ST)

180-D. (German.) **Structural Characteristics of the Low-Shaft Blast Furnaces in the German Democratic Republic.** R. Baake. *Neue Hütte,* v. 1, no. 4, Feb. 1956, p. 202-213; disc., p 213-215.

Design and operation and construction details. Graphs, diagrams. 11 ref. (D1, ST)

181-D. (German.) **Operational Experiences With Low-Shaft Blast Furnaces in the German Democratic Republic.** Hans-Joachim Lux. *Neue Hütte,* v. 1, no. 4, Feb. 1956, p. 216-225.

Service conditions and development of production in the West Iron Works at Calbe (Saale). Operational details. Graphs, photographs. (D1, A5, ST)

182-D. (German.) **Desphosphorizing Basic Converter Steels.** Karl Gorg Speith and Hans vom Ende. *Stahl und Eisen,* v. 76, no. 6, Mar. 22, 1956, p. 323-329; disc., p. 329-331.

Dephosphorization obtained by the addition of fine dephosphorizing agents; temperature losses and afterblow times; possibilities of dephosphorizing by afterblowing with the slag remaining after slagging-off; relations between the final phosphorus content, the iron content of the slag and the temperature; changes in manganese and oxygen content. Graphs, table. (D3, ST)

183-D. (Portuguese.) **Possibilities of Using Hydrogen in the Reduction of Brazilian Powdered Ores.** Janusz Wscieklica. *ABM (Boletim da Associacgo Brasileria de Metais),* v. 11, no. 41, Oct. 1955, p. 389-409.

Advantages or hydrogen reduction; comparison between carbon monoxide and hydrogen as reducing agents; factors affecting reduction time, including reduction temperature and granulometric factor. Graphs, tables, micrographs, diagrams. 23 ref. (D8, Fe)

184-D. Degasifying Steel Under Vacuum. Practice for Large Forging Steel Ingots. Arthur Tix. (From *Stahl und Eisen,* v. 76, no. 2, Jan. 26, 1956, p. 61-68.) *Iron & Steel,* v. 29, Mar. 1956, p. 81-86.

Previously abstracted from original. See item 105-D, 1956. (D8, ST)

185-D. Coreless Induction Furnace. II. K. Scherzer and F. S. Leigh. *Iron and Steel,* v. 29, Mar. 1956, p. 105-108; disc., p. 108-111.

Even considering the limits of application of this type of furnace compared with frequency induction furnace, the coreless type is preferred, owing to lower initial cost. Diagram, graphs, photographs. (D6)

186-D. (French.) **Remarks on the Design of Ingot Molds. Square Ingot Molds for Electric Steel Plants. Flat Ingot Molds for Openhearth Steel Plants.** J. Duflot. *Centre de Documentation Sidérurgique, Circulaire d'Informations Techniques,* v. 13, no. 3, 1956, p. 569-603.

Relationship of ingot mold design to consumption of cast iron per ton of ingot. Graphs, tables. 14 ref. (D9, CI, ST)

187-D. (German.) **A New Method of Electrode Adjustment With Magnetic Amplifiers.** Wilhelm Kafka. *Stahl und Eisen,* v. 76, no. 7, Apr. 5, 1956, p. 381-390.

General remarks on magnetic amplifiers. Design of adjusting equipment and control characteristics in

its application to steel melting and reduction furnaces. Diagrams, graphs, photographs. (D5, ST)

188-D. (German.) **Relations Between the Phosphorus Content of Basic Converter Heats, the Iron Content of the Slag and the Amount of Oxygen Offered During the Last Minutes of Blowing.** Hans von Ende and Gustav Mahn. *Stahl und Eisen,* v. 76, no. 7, Apr. 5, 1956, p. 390-393.

Effect of iron content of the slag and temperature on the phosphorus content of the steel. Oxygen consumption and iron slagging. Oxygen consumption and loss of phosphorus in melting. Graphs. (D3, B21, ST, Fe)

189-D. (Russian.) **Converter Refining of Openhearth Steel by Means of Pure Oxygen.** *Stal',* v. 16, no. 3, Mar. 1956, p. 203-212.

Transformation of basic converter into an oxygen converter. Oxygen process provides carbon steels similar to Martin steels without addition of fluorspar and with very economical results. Tables, diagrams, graphs. 2 ref. (D8, CN)

190-D. (Russian.) **Oxidation of Liquid Steel During and After Teeming From Openhearth Furnace.** *Stal',* v. 16, no. 3, Mar. 1956, p. 214-216.

Study of shape and condition of tap hole and its effect on teeming time, character of flow, and on oxidation of the metal and inclusions in the final product. Tables. (D9, S18, ST)

191-D. (Spanish.) **Low-Temperature Reduction of Iron Ores and the Concentration of Iron Sponge.** Jacques Astier. *Instituto del Hierro y del Acero,* v. 9, no. 43, Feb. 1956, p. 109-117.

Compares methods for processing lean ores. Use of rotating furnace, crucibles, possible elimination of blast furnace, possible use of electric and other furnaces. Magnetic roasting and magnetic separation. Applicability of low-temperature methods is restricted by structure of ore. Tables, graphs. 7 ref. (D8, B15, Fe)

192-D. (Swedish.) **Reduction Experiments on Steep Rock Ore.** John Olof Edström *Jernkontorets Annaler,* v. 140, no. 2, 1956, p. 130-136.

Microscopic and X-ray refraction studies show that this iron ore has a high reducibility and shows promise for the production of sponge iron. Table, micrographs, graph. 7 ref. (D8, Fe)

193-D. (Russian.) **Continuous Casting of Steel.** M. S. Boichenko and V. S. Rutes. *Liteinoe Proizvodstvo,* 1956, no. 3, Mar. 1956, p. 1-4.

Direction of crystallization process in continuous casting of steel and nonferrous metals and its effect on mechanical properties of the product; compares continuous casting techniques in the U.S.S.R. and abroad. Diagrams, photographs, table. (D9, C5, N12, Q general, ST)

E

Foundry

283-E. Top Loading Sealed Cupola Installation Utilizes Automatic Controls. C. E. Smith. *Automation,* v. 3, May 1956, p. 52-56.

Simplification of the handling of raw products in the preparation of molten iron; elimination of air contamination by waste gases associated with the melting process. Diagrams, photographs. (E10, A5)

284-E. Mechanized Foundry Setup for Shell-Cast Pontiac Crankshafts. Joseph Geschelin. *Automotive Industries,* v. 114, Apr. 15, 1956, p. 48-51.

Some features of product economy achieved by mechanization. Photographs. (E16, A5, CI)

285-E. Zinc Die Castings—Their Design and Application. Ernest Horvick. *Electrical Manufacturing,* v. 57, Apr. 1956, p. 94-101.

Design fundamentals and efficient utilization of die castings. Tables, photographs. (E13, Zn)

286-E. Cure Cores With Co_2—in Seconds. P. M. Unterweiser. *Iron Age,* v. 177, Apr. 12, 1956, p. 95-98.

Hard and sound carbon-dioxide treated cores are cured right in the core box in seconds for improved dimensional accuracy. Diagram, photographs. (E21)

287-E. Copper and Copper Alloys. A Survey of Technical Progress During 1955. E. Voce. *Metallurgia,* v. 53, no. 317, Mar. 1956, p. 103-107.

Reviews production, foundry practice and fabrication developments. 88 ref. (To be continued.) (E general, F general, G general, Cu)

288-E. Designing for Investment Casting. John E. Srawley. *Product Engineering,* v 27, Apr. 1956, p. 166-169.

Advantages and limitations of the method, tolerances obtainable, types of pattern materials and casting alloys, preparation of alloy specification, inspection procedures. Graph, photographs. 3 ref. (E15)

289-E. Practical Experiences With Carbon Dioxide Process in Coremaking for Tractor Parts. K. Haake and E. Pfitznann. *Henry Brutcher Translation No.* 3641, 4 p. (From *Giessereitechnik,* v. 1, no. 10. 1955, p. 191-192.) Henry Brutcher, Altadena, Calif.

Most favorable proportion of used sand to be incorporated into cores. Coremaking machines built for foundry. Surface finish of various cores made. Photographs. (E21, T3, CI)

290-E. Tools for Tomorrow's Foundry Progress. *Foundry,* v. 84, May, 1956, p. 106-137.

Developments in mechanization, modernization and automation; future trends in equipment and materials; role of management. (E general, A5, A6)

291-E. How to Use Moldable Exothermic Compounds. *Foundry,* v. 84, May, 1956, p. 150-156.

Application of exothermics and a method for calculating size of feeder heads lined with them. Table, graphs, photographs, diagrams. (E22)

292-E. Is Green-Sand Moulding Deteriorating? Harold Haynes. *Foundry Trade Journal,* v. 100, Apr. 12, 1956, p. 167-172, disc., p. 172-173.

The making of several large castings in green-sand described to show what is possible from the method when intelligently handled. Diagrams, photographs. (E11)

293-E. Cast Manganese Steel. E. Piwowarsky and H. L. Roes. *Foundry Trade Journal,* v. 100, Apr. 12, 1956, p. 177-181.

Indicates temperature at which a casting of given wall thickness should be cast to have a required grain size. Micrographs, photograph, graphs, diagram, tables. (E25, CI)

294-E. A New Combined Degassing-Modification Process. A. Logan. *Light Metals,* v. 19, Apr. 1956, p. 122-125.

Process for simultaneous degassing and modification of aluminum-silicon alloys. Range of aluminum-silicon alloys in use, methods of modification applied. Graphs, photographs, micrographs, tables. (E25, Al)

295-E. Refractory Mould Castings. Arthur Street. *Metal Industry,* v. 88, Apr. 13, 1956, p. 285-289.

Process by which semipermanent ceramic molds are produced. Photographs. (E12)

296-E. New Shell Machine Cuts Resin Costs. R. S. Amala, R. F. Thomson, J. H. Smith and A. L. Boegehold. *Modern Castings,* v. 29, May, 1956, p. 62-65.

Blow-hot press shell molding process makes thinner, stronger shells, makes them faster, and reduces casting warpage. Diagrams, photographs, graphs. (E16)

297-E. Centrifugal Casting of Unusual Shapes in Nonferrous Metals. J. P. Krishon. *Modern Castings,* v. 29, May, 1956, p. 69-71.

A basically simple process with great cost-cutting potential. Photographs. (E14, EG-a)

298-E. Three Ways to Make Epoxy Resin Patterns. E. F. McAfee. *Modern Castings,* v. 29, May, 1956, p. 72-75.

Epoxies are applicable to most methods of pattern manufacture and combinations of materials. Curing equipment is not needed. Photographs. (E17)

299-E. The Foundry of Tomorrow. *Modern Castings,* v. 29, May, 1956, p. 89-112.

Continuous processes, automation, new alloys, metals, and techniques, greater emphasis on precision castings and "as-cast" finishes are predicted. Diagrams. (E general)

300-E. We Cast Steel in Ceramic Molds. D. C. Ekey and E. G. Vogel. *Modern Castings,* v. 29, May, 1956, p. 116-118.

Ceramicast process adds flexibility to casting design and production by offering a quality range between the limitations of conventional sand castings and the unique accuracies of precision castings. Photographs, tables. (E12, CI)

301-E. Facts of Refractory Life. C. C. Lawson and Lyle R. Jenkins. *Modern Castings,* v. 29, May, 1956, p. 123-124.

Service life of eight refractories for air furnace bottoms compared with manufacturers' laboratory tests. Table. (E10, B19)

302-E. (French.) **Piping, Shrinkage Holes and Cavities in Castings.** J. Pascal. *Métallurgie,* v. 88, no. 3, Mar. 1956, p. 249 + 4 pages.

Solidification of castings, inclusion of gas absorbed from the sand, results of excess of blast. Graphs, table. (To be continued.) (E11, E25, CI)

303-E. (Spanish.) **Mineralogical and Technical Study of Spanish Molding Sands.** Vicente Aleixandre Ferrandis and Jaime Robredo Olave. *Instituto del Hierro y del Acero,* v. 9, no. 43, Feb. 1956, p. 118-145.

Sixteen molding sands and earths studied by several methods. Curves of compressive strength of green sands; humidity and weight by volume curves; relation between strength and other factors; permeability and granulometric characteristics; chemical analysis. Tables, photographs, graphs, micrographs. 21 ref. (E18)

304-E. (Spanish.) **Technique of Molding With Sands Agglomerated With Cement.** Luis Barbero Luna and Joaquin Tallada Cabello. *Instituto del Hierro y del Acero,* v. 9, no. 43, Feb. 1956, p. 146-168.

Advantages and disadvantages; origin and development of the technique abroad and in Spain; physi-

cal properties of sands; percentage of granulation and lixiviation; determining concentration of the cement; casting defects; use of technique for cast steel and bronzes. Tables, photographs, diagrams. (E18, CI, Cu)

305-E. Jobbing Production of Light-Alloy Castings. A. S. H. Sawers. *Foundry Trade Journal,* v. 100, Apr. 19, 1956, p. 195-206.

Normal melting procedure for aluminum is given with particular emphasis on the method of preparation prior to pouring; grain refining, fluxing, degassing and modification. Production of a number of castings from sand molds and by die-casting described in detail. Photographs, tables. (E general, Al)

306-E. Sealing Micro-Porosity in Light Metal Castings. Marvin Schneider and Henry Siesel. *Light Metal Age,* v. 14, Apr. 1956, p. 20-22, 31.

Vacuum-pressure impregnation method insures pressure tightness in castings where brittleness is of little consequence. Photographs. (E25, Q23, EG-a)

307-E. Application of the Phi Scale to the Description of Industrial Granular Materials. C. H. Bowen. *Mining Engineering,* v. 8; *American Institute of Mining & Metallurgical Engineers Translations,* v. 8, Apr. 1956, p. 420-424.

The phi scale is related to other systems and conversion is explained. Illustrations of use to specify foundry sand and other aggregate and powdered materials. Graph. 3 ref. (E18)

308-E. (Czech.) Production of Castings Made From Acid-Proof Silicon Cast Iron. Jan Hucka. *Slévarenstvi,* v. 4, no. 3, Mar. 1956, p. 68-74.

Equipment and methods, including casting design, molding, heat-treatment and repairing casting defects. Table, graph, diagrams. 11 ref. (E11, J general, CI)

309-E. (Czech.) Importance and Different Systems of Foundry Sand Reclamation. B. Kamenicky. *Slévarenstvi,* v. 4, no. 3, Mar. 1956, p. 74-79.

Principles of wet, dry, pneumatic and thermal reclamation procedures. Sand classification methods. Diagrams, photograph. 15 ref. (E18)

310-E. (French.) Production of Boxes for Blown Cores. Louis Marotine. *Fonderie,* 1956, no. 122, Mar. 1956, p. 98-106.

Materials used for boxes; number of impressions per box; protection of boxes against wear; removal of cores. Diagrams. (E21)

311-E. (German.) Efficiency of a Cupola Furnace. Hans Jungbluth. *Giesserei,* v. 43, no. 8, Apr. 12, 1956, p. 180-184.

Thermal and metallurgical efficiencies, smelting capacity and temperature in relation to amount of coke in the charge, effect of cupola losses on the economy of the process, favorable conditions of operation. Tables, graphs. 5 ref. (E10, CI)

312-E. (Italian.) Designing From the Point of View of Obtaining Good Castings Without Internal Stresses, Porosity, Blowholes, Etc. F. Velicogna. *Fonderia,* v. 5, no. 3, Mar. 1956, p. 115-122.

Solution of day-to-day design problems to obtain better and cheaper castings. Diagrams, photographs. 4 ref. (E11, E25, CI)

313-E. (Russian.) Precision Casting of Heavy-Weight Articles. N. G. Romanovskii. *Liteinoe Proizvodstvo,* 1956, no. 3, Mar. 1956, p. 5-6.

Carbon dioxide blast techniques employed in manufacturing precision casting molds in the U.S.S.R. and abroad. Use of quick-drying sand mixes with water glass. Table, photographs, diagrams. 7 ref. (E19, E15)

314-E. (Russian.) Thermosetting Resins for Investment Molds. K. M. Tkachenko and A. I. Bogdanov. *Liteinoe Proizvodstvo,* 1956, no. 3, Mar. 1956, p. 8-10.

Technological properties of various synthetic resins used as binders in investment molds. Classification system for industrial resins. Tables. (E15, E18)

315-E. (Book.) Foundry Practices. S. E. Rusinoff. 261 p. 1955. American Technical Society, Drexel Ave. at 58th St., Chicago 37, Ill. $6.50.

Various manufacturing processes applied to metal casting. Useful tables and extensive bibliography. (E general)

F

Primary Mechanical Working

109-F. Forging Alloys for High-Temperature Service. *Metal Industry,* v. 88, Mar. 23, 1956, p. 225-226.

Investigations of alloys suitable for high-temperature service in jet engines. Tables. (F22, T25, SG-h)

110-F. How to Improve Structural Homogeneity of Hot-Rolled (Strip) Steel. V. A. Shadrin, M. A. Benyakovskii and S. G. Guterman. *Henry Brutcher Translation No.* 3599, 8 p. (From *Stal,* vol. 15, no. 1, 1955, p. 86-88.) Henry Brutcher, Altadena, Calif.

Ways of preventing the occurrence of coarse precipitate in three hot-rolled strip steels, based on hot rolling trials, various cooling rates and micro-examination. Table, graph, micrographs. (F23, ST)

111-F. Textures of Rolled and Recrystallized Titanium. N. V. Ageev and A. A. Babareko. *Henry Brutcher Translation No.* 3635, 9 p. (From *Izvestiya Akademii Nauk SSSR, OTN,* no. 8, Aug. 1955, p. 100-106.) Henry Brutcher, Altadena, Calif.

Effect of rolling temperatures and amount of reduction in rolling upon the degree of perfection of the texture of iodide, magnesium-thermit and hydride titanium. Effect of recrystallization after reduction. X-ray diffraction patterns, diagrams. 12 ref. (F23, N5, Ti)

112-F. Performance of Various Emulsions in the Cold Rolling of Strip Steel. H. Pannek. *Henry Brutcher Translation No.* 3639, 13 p. (Abridged from *Stahl und Eisen,* v. 75, no. 12, 1955, p. 767-769.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 163-F, 1955. (F23, ST)

113-F. (Czech.) Experimental Rolling of Transformer Bands for High-Tension-Current Electrotechnics. Rudolf Pulpan. *Hutnické Listy,* v. 11, no. 3, Mar. 1956, p. 132-134.

Production of anisotropic silicon steel bands 260 mm. wide, including melting, production of slab blooms, and hot and cold rolling. Table. 1 ref (F23, D9, SG-p)

114-F. Scale-Free Heating of Steel at 2200° F. W. Trinks. *Industrial Heating,* v. 23, Apr. 1956, p. 718 + 4 pages.

Investigation of the known methods of heating steel to rolling and forging temperatures; discussion of their practicability. Diagrams, (F21, ST)

115-F. The Hot Forming of Magnesium Alloys. R. G. Wilkinson. *Institute of Metals, Journal,* v. 84, Mar. 1956, p. 217-228.

Compositions and mechanical properties of the principal wrought alloys; data on the effects of heating on the properties, special requirements in equipment, procedures for hot-forming sheet and extrusions. Diagrams, graphs, tables. 8 ref. (F general, Q general, Mg)

116-F. Ultimate Capacity of a Slabbing Mill. H. G. Jones, D. T. Steer and P. D. Dickerson. *Operational Research Quarterly,* v. 7, Mar. 1956, p. 1-11.

Problems in estimating ceiling capacity of the unit which controls the total output in a particular steelworks. Graphs, tables. (F23, ST)

117-F. Fabrication of Titanium Prototypes of 81-MM. Mortar Base Plate. R. W. Huber. *U. S. Bureau of Mines, Report of Investigations* 5179, Mar. 1956, 32 p.

Successful development of a titanium prototype; information dealing with forming, forging and machining, welding and assembly techniques; design changes relative to this prototype. Photographs, table. 3 ref. (F general, G general, K general, Ti)

118-F. The Rolling of Metals and Alloys. IX. Hot Rolling: Calculating the Roll-Separating Force. E. C. Larke. *Sheet Metal Industries,* v. 33, no. 347, Mar. 1956, p. 209-213.

Comparison between calculated and measured loads. Loads were calculated for 71 different hot rolling conditions. Graphs, table. 1 ref. (To be continued.) (F23)

119-F. (German.) Fine Forging and Forging Equipment. K. W. Michler. *Metall,* v. 10, no. 7-8, Apr. 1956, p. 293-297.

Machines, methods, applications, advantages. Diagrams, photographs. (F22)

120-F. (German.) Present State of the Scientific Knowledge in Hot Shaping and Forging. Erich Siebel. *Stahl und Eisen,* v. 76, no. 7, Apr. 5, 1956, p. 393-397.

Relations between the resistance to deformation and the stresses. Law of constancy of volume; law of flow. Deformation losses. Flow curves of various materials. Relations between rate of deformation and resistance to deformation. Process of upsetting and press forging. Tables, graphs, diagrams. 4 ref. (F22)

121-F. (Spanish.) Development of the Process for Conditioning Steel Surfaces. I-II. H. R. Pufahl. *Fusion de Metales,* v. 18, no. 1, Jan.-Feb. 1956, p. 17-28; Mar.-Apr. 1956, no. 2, p. 16-28.

Use of new types of torches for scarfing and automatic machines for conditioning the surfaces of billets, ingots and plate. Types of surface defects (seams, scabs and laps), methods and equipment to correct them. Photographs, tables. (F21, ST)

122-F. The Production of Extruded Steel Sections. *Machinery (London)* v. 88, Apr. 20, 1956, p. 478-490.

Application of the Ugine-Sejournet process and use of a new type of Italian billet-heating furnace. Diagrams, table, photographs. (F24, ST)

123-F. Production of Compressor and Gas Turbine Blades. A. T. Col-

well. *Machinery (London)* v. 88, Apr. 20, 1956, p. 503-506.

Precision forging and powder metallurgy methods. Photographs. (F22, H general)

124-F. The Predetermination of Tensile Strengths in Steel Wire Manufacture. II. C. Coates. *Wire Industry,* v. 23, Apr. 1956, p. 319-320.

Possible causes of tensile variation. Includes effect of heat treatment, variation of carbon content, air patenting and drawing speeds. (F28, Q27, ST)

125-F. (French.) **Aluminium Alloy Forged Pieces and Sections. VII. Study Elements.** Robert Colomb. *Revue de l'Aluminium,* v. 33, no. 229, Feb. 1956, p. 162-167.

Forging control operations, size and quantity tolerances, methods of detecting defects, protection against corrosion. Tables, micrographs, diagram. (F22, R general, Al)

126-F. (Book.) **Forging and Welding.** Robert E. Smith. 160 p. 1956. McKnight & McKnight Publishing Co., Market & Center Sts., Bloomington, Ill.

Safety precautions, forging equipment and procedures, oxy-acetylene, gas-arc and electric-arc welding. (F22, K1, K2)

G

Secondary Mechanical Working

175-G. How to Understand Spark Erosion. R. Decat. *American Machinist,* v. 100, Apr. 23, 1956, p. 113-118.

Electronic-erosion equipment and techniques as a solution to cutting harder and tougher materials. Diagrams, photographs. (G17)

176-G. Get Rid of Kinks by New Tube-Forming Methods. W. G. Patton. *Iron Age,* v. 177, Apr. 19, 1956, p. 95-98.

Hydraulically operated expanding mandrels hug inside walls of rectangular tubes throughout bending operations, leaving no room for kinks. Photographs. (G6)

177-G. Design Dies Today, Start Stamping Tomorrow. C. B. Moore. *Iron Age,* v. 177, Apr. 19, 1956, p. 99-102.

Cookie-cutter-type dies are quickly built and provide a low cost method to produce stamped parts involving normal tolerances. Table, photographs. (G3)

178-G. Investigations Into Blade Root Fixings of High-Temperature Steels. W. Siegfried. *Sulzer Technical Review,* v. 37, no. 3, 1955, p. 34-52.

The choice of metals and structural designs for components subjected to high temperatures and stresses, especially for the blade roots of gas turbines. Diagrams, graphs, photographs, tables. 3 ref. (G17, T25, ST)

179-G. Fabrication of Zirconium Shells. R. S. French, C. H. Mayer and R. S. Pratt. *Bridgeport Brass Company (U. S. Atomic Energy Commission),* SEP-127, Dec. 1952, 43 p.

Deep drawing test results for cupping, folding and ironing indicate that the metal can be readily cold formed to fairly large reductions in diameter. Photographs, micrographs, graphs, tables. 7 ref. (G4, Zr)

180-G. (English.) **On the Surface Roughness in Grinding.** Kenji Sato. *Technology Reports, Tohoku University,* v. 20, no. 1, 1955, p. 59-70.

An analytical formula for the surface roughness in grinding effects of grinding wheels and operating conditions. Diagrams, photograph, tables, graphs. 7 ref. (G18, S15)

181-G. (German.) **Deep Etching Instead of Milling.** *Aluminium,* v. 32, no. 4, Apr. 1956, p. 214-216.

Parts of surface not to be etched are masked with a coating which resists the etchant, and the whole component is immersed in etching solution. Diagrams, photographs, micrographs. (G17)

182-G. (Russian.) **Machining Various Materials by Means of Ultrasonic Vibrations.** I. V. Metelkin, V. E. Popov, V. I. Nikol'skii, V. V. Metelkin and N. A. Mukaseev. *Stanki i Instrument,* v. 27, no. 2, Feb. 1956, p. 16-19.

Three types of ultrasonics: electrodynamic (up to 20 kc.), magnetostrictive (15 to 150 kc.), prezoelectrical (over 150 kc.). Speed and behavior of liquids and particles vibrated by ultrasonics, types of apparatus used, cone and exponential transformers, effect of size of abrasive grain. Photographs, graphs, table, diagrams. (G17)

183-G. (Russian.) **Procedures of Underwater Gasoline-Oxygen Cutting of Steel.** V. M. Agapov. *Svarochnoe Proizvodstvo,* 1956, no. 3, Mar. 1956, p 25-26.

Performance ratings of an underwater cutting device operating on a mixture of gasoline and oxygen. Compares tests and laboratory data with actual performance. Tables, graphs. 4 ref. (G22, ST)

184-G. Research Into Some Metal-Forming and Shaping Operations. W. Johnson. *Institute of Metals, Journal,* v. 84, Mar. 1956, p. 165-179.

Investigations into the drawing and redrawing of cylindrical shells with hemispherical and flat-headed punches, with particular reference to the effects of lubrication, drawing speed and flange wrinkling; ironing, tube-sinking, detection and measurement of residual stresses in cold drawn tubes, impact extrusion under a drop hammer, coining. Diagrams, graphs, table. 14 ref. (G general)

185-G. Cold Roll-Forming and Manipulation of Light-Gauge Sections. E. Griffin. *Institute of Metals, Journal,* v. 84, Mar. 1956, p. 181-197.

Advantages of cold forming for producing sections of complicated profile from strip in large quantity. Types of machines used and their capacities, calculation of power requirements, design and manufacture of roll-forming tools. The operation of cold roll forming machines; use of press brakes for forming simple sections. Diagrams, graphs, tables. (G11)

186-G. Stretch-Forming of Non-Ferrous Metals. R. D. Edwards. *Institute of Metals, Journal,* v. 84, Mar. 1956, p. 199-209.

Limitations of method; effects of heat treatment and differential work-hardening; type of stretch-forming and stretch-wrapping machines; design of and materials for tools. Diagrams, graphs. 15 ref. (G9, J general)

187-G. Bending and Allied Forming Operations. T. G. Perry. *Institute of Metals, Journal,* v. 84, Mar. 1956, p. 211-216.

Metallurgical factors involved in plain bending, tube bending, flanging and rolling. The concept of the strain-hardening exponent used to provide empirical relationships for rolling machine capacities and for buckling criteria in bending. Graph, table. 8 ref. (G6)

188-G. Fundamentals of Electrical Discharge Machining. *Machinery,* v. 62, May 1956, p. 139-145.

Fundamental information about the electrical discharge process, based on translations of Russian technical papers and operations being performed at various industrial plants in the U.S.S.R. Diagrams, graphs, tables. (G17)

189-G. Know Your Cutting Fluids. R. K. Gould and R. C. Givens. *Machinery,* v. 62, May 1956, p. 150-154.

Action of cutting fluids, examines complex role assigned to these petroleum products. Photographs. (G21)

190-G. Working Today's Metals. I. Hot Rubber Pressing Forms Titanium Sheet. J. Fielding. *Metalworking Production,* v. 100, Apr. 13, 1956, p. 325-328.

Experiments to assess formability by rubber pressing on sheet material of Ti-75A (American) and of Ti-130 (British). Tables, photograph. (G8, Ti)

191-G. Research Throws Light on Machining Nimonic and Titanium. D. F. Galloway. *Metalworking Production,* v. 100, Apr. 13, 1956, p. 328-331.

Torque and thrust exerted when drilling groups of nonferrous and ferrous materials are compared. Relationships between tool life, cutting speed, feed rate. Graphs, diagrams, photographs, table. (G17, Tl, Ni)

192-G. Limited - Quantity Production of Stampings. Federico Strasser. *Sheet Metal Industries,* v. 33, no. 347, Mar. 1956, p. 179-182.

Details of tooling to effect cost economy when producing relatively small batches of parts. Diagrams. (G3)

193-G. (Polish.) **Production of Deep Drawing Steel Sheets.** Z. Wusatowski and R. O'Donnel. *Prace Instytutow Ministerstwa Hutnictwa,* v. 8, no. 1, 1956, p. 27-39.

Properties which distinguish auto body sheets of good quality; factors which influence these properties; special reference to production technology of steel sheets. Tables, micrographs, diagrams. 16 ref. (G4, F23, ST)

194-G. (Russian.) **Effect of Chemical Composition and Microstructure on the Machinability of Chromium Cast Irons.** M. M. Levitan. *Metallovedenie i Obrabotka Metallov,* 1956, no. 2, Feb. 1956, p. 50-52.

Effect of annealing and other heat treatment variations on hardness. Effect of carbon content. X-ray study of carbides. Graphs, tables, micrographs. (G17, Q29, J23, M27, CI)

195-G. How Versatile Is Your Punch Press Operation? Gilbert C. Close. *Finish,* v. 13, May, 1956, p. 33-36.

Details of the versatility of the shop press; its range of possible operations and example of economies possible. Photographs. (G2)

196-G. Are Poor Bends Draining Your Stamping Profits? Federico Strasser. *Iron Age,* v. 177, May, 3, 1956, p. 100-103.

Stampers and designers can apply the basics of bending with success. Shop tested, they reflect advanced thinking on trouble-shooting approaches most likely to hold stamping costs down to a competitive level. Diagrams, tables. (G3)

197-G. Precision Slicer Shaves Metal Waste. *Iron Age,* v. 177, May 3, 1956, p. 106.

Unit is an automatic hydraulically actuated, circular sawing device, employing a thin, circular diamond saw blade. Rates as low as 1/16 ipm. are possible. Photograph. (G17, Ge)

198-G. Cutting Fluids. *Lubrication,* v. 42, Apr. 1956, p. 49-60.
Various types of cutting fluids, their application and properties. Practical considerations on the care and handling of soluble oils. Diagram, photographs, tables. (G21)

199-G. Working Today's Metals. II. Lubricant Is Important in Deep Drawing Nimonic 75. John A. Grainger. *Metalworking Production,* v. 100, Apr. 20, 1956, p. 370-372.
Studies were made to determine what reductions in diameter are possible with Nimonic 75 sheet. Producing parts in this high-strength material by clamp-plate blankholding on a single-action press. Graphs, photographs, table. 13 ref. (G4, Ni)

200-G. How to Select Steels for Best Machinability. Howard E. Boyer. *Modern Machine Shop,* v. 28, May, 1956, p. 162 + 6 pages.
Machining properties of steel and how to achieve better machining characteristics by the route of material selection. (G17, ST)

201-G. How to Draw Titanium. *Steel,* v. 138, May 7, 1956, p. 98-99.
Application, drawability, method, dies, relief, lubrication and final operations. Photographs, diagrams. (G4, Ti)

202-G. The Abrasive Belt and Its Use in Machine Tools. J. K. McLaughlin. *Tool Engineer,* v. 36, May, 1956, p. 88-94.
Over 60 examples of application for this rapidly expanding technique are illustrated. Diagrams, photographs. (G18)

203-G. Soluble Oils. R. K. Gould and R. C. Givens. *Tool Engineer,* v. 36, May, 1956, p. 104-106.
Story of soluble cutting oils, including their composition, handling in storage, preparation of emulsions and factors affecting performance. (G21)

H Powder Metallurgy

70-H. Fabrication of Thorium Powders. W. W. Beaver, K. G. Wikle and J. G. Klein. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Apr. 1956, p. 445-454.
Consolidation of hydride process, electrolytic, calcium reduced and comminuted thorium powder, as well as saw chips and lathe turnings, by vacuum hot pressing and by cold pressing-vacuum sintering. Mechanical properties of the consolidated material in the extruded form compared with those of wrought castings. Diagram, graphs, micrographs, photographs, tables. 26 ref. (H14, Q general, Th)

71-H. Selecting Cermets for High-Temperature Applications. J. T. Norton. *Machine Design,* v. 28, Apr. 19, 1956, p. 143-146, 148.
Fabrication of carbide parts, properties of carbide, boride and oxide-base cermets, intermetallics. Graphs. (H general, Ti, C-n)

72-H. Aluminum Powder Metallurgy Products. John P. Lyle, Jr. *Materials & Methods,* v. 43, Apr. 1956, p. 106-111.
Compacts of fine aluminum powder containing aluminum oxide have outstanding strengths above 600° F. Two APM alloys raise the useful range of aluminum alloys by about 300° F. Tables, graphs, photograph. 5 ref.
(H12, Q general, T general, Al)

73-H. Cermets for High Temperature Service. J. T. Norton. *Mechanical Engineering,* v. 78, Apr. 1956, p. 319-322.
Ceramics combine with metals to meet the critical demands of modern technology. Graphs, micrographs. (H general)

74-H. High-Temperature Parts Based on Titanium Carbide. Walther L. Havekotte. *Metal Progress,* v. 69, Apr. 1956, p. 56-61.
Properties vary with composition of metallic binder, carbon content and porosity. Manufacturing methods are stabilized for products of light weight and high rupture strength, all are quite brittle at room temperature. Graphs, micrographs, photographs, tables.
(H general, Ti, C-n)

75-H. (Dutch.) **Copper and Copper Alloys. XV. Powder Metallurgy, Its Special Application to Copper and Copper Alloys.** W. G. R. de Jager. *Metalen,* v. 11, no. 5, Mar. 15, 1956, p. 109-113.
Physical properties of metal powders. Particle size, shape and arrangement. Tables, graph. 2 ref. (To be continued.) (H11, Cu)

76-H. (French.) **Preparation and Utilization of Metal Powders.** M. Van Den Bosch. *Métaux, Corrosion-Industries,* v. 31, no. 366, Feb. 1956, p. 53-69.
Sintering, mechanical, chemical, pulverization and electrolytic methods of preparation, properties and uses. Diagrams, tables, photographs, micrographs. (H general)

77-H. (French.) **Production and Use of Metallic Carbides and Heavy Alloys.** Robert Girschig. *Métaux, Corrosion-Industries,* v. 31, no. 366, Feb. 1956, p. 80-93.
Production and sintering of tungsten carbide, uses of tungsten-base and other heavy alloys. Photographs, graph, micrographs.
(H general, T6, EG-h, W)

78-H. (German.) **The Sintering Reaction.** E. Meyer-Hartwig. *Berichte der Deutschen Keramischen Gesellschaft,* v. 33, no. 3, Mar. 1956, p. 85-91.
Classification and significance of semimetallic material. Physics of sintering and sintering mechanism of metals and metal compounds. The sintering reaction and its evaluation. Process, application and materials used. Thermal data and graphs of reactions. Tables, diagrams, photographs. (H15)

79-H. (Swedish.) **Reduction Structures of Iron Powder.** John Olof Edström. *Jernkontorets Annaler,* v. 140, no. 2, 1956, p. 116-129.
By selecting a suitable degree of oxidation, reduction temperature and gas composition, it is possible to control amount and appearance of pores in iron powder directly reduced by gas from concentrate. Micrographs, graphs, tables. 3 ref.
(H10, H11, Fe)

80-H. Fabrication of Beryllium and Zirconium Shapes by Power Metallurgy. A. J. Stonehouse and W. W. Beaver. *Brush Beryllium Company, (U. S. Atomic Energy Commission),* BBC-51, May, 1950, 51 p.
A means of rolling nickel-jacketed sheets of beryllium and zirconium, extrusion of various shapes of their sinters. Tables, diagram, photographs. (H general, F23, F24, Be, Zr)

81-H. Nickel-Cadmium Batteries. I. Sintered Plates From a New Canadian Nickel Powder. E. J. Casey, P. L. Bourgault and Phyllis E. Lake. *Canadian Journal of Technology,* v. 34, May, 1956, p. 95-103.
Sintered plates of high porosity and good mechanical strength were made from a new domestic nickel powder. New plates had 15 to 30% less capacity loss than commercial plates at high discharge rates. Tables, micrographs. 8 ref.
(H general, T1, P15, Ni, Cd)

82-H. Titanium-Carbide-Base Cermets for High-Temperature Service. K. Pfaffinger, H. Blumenthal and F. W. Glaser. Paper from "Symposium on Metallic Materials for Service Temperatures Above 1600° F". American Society for Testing Materials, p. 90-99; disc., p. 99-102.
Development of cermets containing 25 to 65% of nickel-chromium or nickel-cobalt-chromium binder. Physical properties, production procedures, applications. Diagram, micrographs, photographs, graphs, tables. 7 ref.
(H general, Q general, C-n)

83-H. Titanium-Carbide Products Produced by the Infiltration Technique. Leonard P. Skolnick and Claus G. Goetzel. Paper from "Symposium on Metallic Materials for Service at Temperatures Above 1600° F". American Society for Testing Materials, p. 103-109; disc., p. 110.
Impact strength is superior to that of the conventional cemented materials. Technique permits the use of low pressures for compacting the powders, making possible direct pressing of complex shapes. Photograph, graphs, table, micrographs. 5 ref. (H16, Ti)

84-H. Cermets. John W. Graham and John C. Redmond. Paper from "High-Temperature Technology". John Wiley & Sons. p. 208-232.
Fundamental characteristics; composition and properties; oxide-interstitial compounds-metal cermets; carbide-type cermets; stress-rupture strength. Applications of cermets. Graphs, photograph, tables. 29 ref. (H general)

85-H. Sintering of Metallic and Nonmetallic Refractory Materials. D. R. Wilder. Paper from "High-Temperature Technology". John Wiley & Sons. p. 235-250.
Deals primarily with pure ceramic and hard-metal refractory sintering mechanisms with occasional references to the low-melting metals and pure refractory metals for illustrative purposes. 117 ref. (H15)

J Heat Treatment

127-J. New Furnace Combines Annealing, Vacuum Degassing. *Iron Age,* v. 177, Apr. 12, 1956, p. 102-103.
In heat treating where metal degassing is a factor, vacuum furnaces offer a number of distinct advantages. Photograph. (J2, J23)

128-J. Stabilization of Aluminum Alloy Castings. G. B. Olson. *Metal Progress,* v. 69, Apr. 1956, p. 79-80.
To obtain the precise dimensional tolerances required for instrument components, aluminum alloy castings are stabilized by treatment at both −150 and 450 to 475° F. Stabilization does not affect mechanical properties or corrosion resistance. Diagram, photograph, table. (J1, Al)

129-J. Gas Carburizing Under Pressure. (Digest of "Gas Carburizing Under Pressure", by O. P. Sorokina and D. I. Bron; *Metallovedenie i Obrabotka Metallov*, no. 1, 1955, p. 47-50.) *Metal Progress*, v. 69, Apr. 1956, p. 170, 172.

Two carburizing processes were studied, one that takes place at the interface between the metal and the carburizing medium, another that occurs in the steel itself. Experiments show that higher pressures accelerate the process of saturation of the surface layer of the steel with carbon. Graph. (J28, ST)

130-J. On the Nature of Spottiness in a Chrome-Molybdenum-Aluminum Nitriding Steel. V. D. Oreshkin. *Henry Brutcher Translation No.* 3598, 5 p. (From *Stal*, v. 15, no. 1, 1955, p. 69-70.) Henry Brutcher, Altadena, Calif.

Spottiness in 38KhMYuA steel is like a segregation which has its origin in local carbon enrichment of the ingot and is mainly due to contamination by nonmetallic inclusions. Diagrams, micrographs. (J28, AY)

131-J. Surface Hardening of Machine Parts by the Electrospark Process. L. A. Mirkin. *Henry Brutcher Translation No.* 3630, 11 p. (From *Vestnik Mashinostroeniya*, v. 35, no. 4, 1955, p. 48-51.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 110-J, 1955. (J28, ST, CI)

132-J. Electrospark Surface Hardening of Machine Details. A. V. Polyachenko. *Henry Brutcher Translation No.* 3640, 15 p. (From *Vestnik Mashinostroeniya*, v. 34, no. 7, 1955, p. 65-70.) Henry Brutcher, Altadena, Calif.

Surface hardening of carbon steels and gray iron by electrosparking, using cemented-carbide electrodes of different compositions (tungsten carbide plus various cobalt contents and different titanium carbide additions). Effects on mechanical properties; applications. Tables, graphs, micrographs. 5 ref. (J28, Q general, CN, CI)

133-J. How to Heat Treat Beryllium Copper. Anthony Sorrentino. *Industrial Heating*, v. 23, Apr. 1956, p. 699 + 8 pages.

Parts are formed or machined in a relatively soft condition, then given a low-temperature heat treatment to produce maximum properties. Process offers flexibility of design. Micrographs, photographs, graph, tables. (J general, Cu)

134-J. Mechanized Continuous Furnaces. II. George C. McCormick. *Industrial Heating*, v. 23, Apr. 1956, p. 708 + 5 pages.

Several types of mechanized continuous furnaces; considerations for mechanizing a process. Diagrams, photographs. (J general)

135-J. Modern Case-Hardening Processes. P. F. Hancock. *Iron and Steel*, v. 29, Mar. 1956, p. 87-93.

Brief review of case hardening processes, with emphasis on those in which major developments have occurred in recent years. Diagrams, graphs, photographs. (J28)

136-J. Some Effects of Micro-Segregation. H. Allsop. *Iron and Steel*, v. 29, Mar. 1956, p. 95-98, 103.

Many types of stubs were examined and conclusions are based on a large number of Jominy end-quench curves representing the hardenability at the surface and various internal positions in a variety of large bars. (To be continued.) Graphs, photographs. (J26, M27, ST)

137-J. The Tempering and Nitriding of Some 3% Chromium Steels. C. C. Hodgson and H. G. Baron. *Iron and Steel Institute, Journal*, v. 182, Mar. 1956, p. 256-265.

Response to nitriding of a series of steels of the En 40 type was investigated, with particular reference to the effect of previous heat treatment and of carbon and vanadium content. Hardness readings were taken after tempering and depth-hardness curves were plotted after nitriding. Diagram, graphs, tables. 11 ref. (J28, J29, Q29, ST)

138-J. (French.) **Heat Treatment in Controlled Atmosphere.** *Métallurgie*, v. 88, no. 3, Mar. 1956, p. 261, 263-265, 267.

Various types of atmospheres to be used with copper and steel; conditions of use; gaseous cementation. Tables, diagrams, photographs, graphs. (J2, J28, ST, Cu)

139-J. (German.) **Cr-Ni Case Hardened Steels According to DIN 17210 in Comparison With DIN 1662 Steels.** Heinz Kiessler. *Schweizer Archiv für Angewandte Wissenschaft und Technik*, v. 22, no. 3, Mar. 1956, p. 93-96.

Comparative survey of the two standardized German steels. Tables, graphs. 5 ref. (J28, ST)

140-J. Commerical Bright Hardening of Stainless Steels. *Canadian Metals*, v. 19, Apr. 1956, p. 51-52.

Investigation of potentialities of a high-temperature, gas-fired, muffle furnace. Photograph. (J26, SS)

141-J. Current Trends in Heat Treating Light Metals. George H. Thurston. *Light Metal Age*, v. 14, Apr. 1956, p. 14-15.

Automatic handling, use of salt bath furnaces, various heat treating problems. (J general, A5, Al)

142-J. Dimensional Control Through Heat Treat. John W. Greve. *Tool Engineer*, v. 36, May, 1956, p. 119-124.

Heat treat distortion can often be economically compensated in large production runs. Steps to consider in this problem. Table, diagrams, photographs. (J22, J26)

143-J. Resistance and Induction-Heated Furnaces. Paper from "High-Temperature Technology". John Wiley & Sons. p. 259-332.

Graphite resistor furnace, tungsten and oxide resistor heating elements, high-vacuum furnace, arc furnaces, methods of achieving high temperatures. Diagrams, graphs, photographs, tables. 80 ref. (J general)

144-J. Means of Achieving High Temperatures and Some of Their Limitations. E. M. Sherwood. Paper from "High-Temperature Technology". John Wiley & Sons. p. 251-258.

Resistor furnaces, induction-heating equipment, and arc furnaces as means for producing elevated temperatures. Table. 49 ref. (J general)

145-J. (German.) **Annealing of Malleable Cast Iron in a Gas Atmosphere.** Karl Roesch and Hellmut Friederichs. *Giesserei*, v. 43, no. 8, Apr. 12, 1956, p. 177-180.

Practical application of equilibrium diagrams during annealing in CO-CO_2-H_2-H_2O mixtures. Description and operation of annealing furnaces. Diagrams, photographs. 4 ref. (J23, N8, CI)

146-J. (Russian.) **Carburizing Middle-Alloy Carbon Steel.** E. M. Morozova and A. P. Skuzovatova. *Stanki i Instrument*, v. 27, no. 3, Mar. 1956, p. 26-29.

Strength of carburized parts in relation to carbon content of steel, depth of carburized layer, strength of core, other factors. Hardness in relation to depth of carburized layer. Recommendations of specific steels. Graphs, tables. 2 ref. (J28, Q23, Q29, AY, CN)

K

Joining

238-K. Inert Gas-Shielded Welding Arc Behavior and Metal Transfer Characteristics. G. M. Skinner and D. M. Yenni. *Applications and Industry*, 1956, no. 23, Mar. 1956, p. 28-32.

Influence of shielding-gas composition on arc stability, spatter formation and efficiency of metal transfer; some innovations in experimental methods and photography. Graph, photographs, tables. 3 ref. (K1, Al, ST)

239-K. Spot Welding of Ames Thorium. R. E. Monroe, D. C. Martin and C. B. Voldrich. *Battelle Memorial Institute (U. S. Atomic Energy Commission)*, BMI-725, Jan. 1952, 17 p.

Tests determined proper welding conditions and effects of varying welding time, pressure and current pattern on the strength of spot welds in thorium sheet. Micrograph, graphs, diagram, photograph, table. (K3, Th)

240-K. Five Metal Hydrides as Alloying Agents on Silicon. Miles V. Sullivan and John H. Eigler. *Electrochemical Society, Journal*, v. 103, Apr. 1956, p. 218-220.

Good ohmic contacts to both *n*- and *p*-type silicon were made. Graphs, diagrams, table, photographs. 2 ref. (K7, P15, Si)

241-K. Stainless Steel Argon-Shielded Arc Weld Tests. R. L. Heckman. *Hanford Atomic Products Operation (U. S. Atomic Energy Commission)*, HW-12326, Mar. 17, 1949, 25 p.

Inherent characteristics of inert-gas shielded-arc welding. Tests designed to provide data concerning techniques to be used with this method to obtain best possible welds in the field. Techniques include heat treatment after welding, purging, and combinations of parent metal and filler rod to be used. Photographs, tables, graphs, micrographs. (K1, SS)

242-K. Consumable Electrode Inert Arc Welding of Magnesium. I. Paul Klain. *Industry & Welding*, v. 29, Apr. 1956, p. 50 + 7 pages.

Process and its advantages; shielding gas make-up. Graphs. (K1, Mg)

243-K. Resistance Welding Copper-Base Alloys. *Industry & Welding*, v. 29, Apr. 1956, p. 58-60, 89.

Welding requirements include higher currents, shorter time and lighter pressures than for mild steel. Tables. (K3, Cu)

244-K. Electronic Stopwatch Boosts Weld Quality. *Iron Age*, v. 177, Apr. 19, 1956, p. 106-107.

Cold cathode-type electronic circuits promise a precision in weld cycling excelled only by astronomical timers. Photograph. (K3)

245-K. Aluminum Alloys for Welding. W. M. Rogerson. *Machine Design*, v. 28, Apr. 19, 1956, p. 103-106.

Tempering effect, strength requirements, crack sensitivity, corrosion resistance and finish are important design considerations influencing selection of the best alloy and welding method. Tables, photographs. 1 ref. (K general, Q23, R general, Al)

246-K. Welding Rod Coatings Without Ferromanganese. (Digest of "Some Experiments on High-Manganese Arc Welding Rods", by D. R.

Dhanbhoora, S. Visvanathan and S.N.A. Narayan; *Tisco*, v. 2, Oct. 1955, p. 173-177.) *Metal Progress*, v. 69, Apr. 1956, p. 192.

Experiments to develop a coating free from ferromanganese which would enable good welds to be made with high-manganese wire. The best coating contained 16 parts silica, 10 parts manganese ore, 5 parts rutile, 4 parts mill scale, 4 parts bentonite, 2 parts of iron powder. (K1, Fe, Mn)

247-K. How Sound Are Inert-Gas-Tungsten-Arc-Root-Pass Wipe Welds? Helmut Thielsch. *Power Engineering*, v. 60, Apr. 1956, p. 78-80.

Examples of incipient failure, usually in design, and steps to avoid them. Diagrams, photographs. (K1)

248-K. Soldering and Printed Circuits. *Tin and Its Uses*, 1956, no. 34, p. 7-9, 15.

Essentials of electronic circuits, printed circuits, automatic assembly, requirements of the solder. Photographs. (K7, Sn-c)

249-K. Metal Adhesives. R. A. Johnson. *Welding and Metal Fabrication*, v. 24, Apr. 1956, p. 134-136.

Properties and applications of organic adhesives. Table, diagrams, photographs. (K12)

250-K. New Fastening Techniques at Douglas. John H. Stansbury and J. M. Rakestraw. *Western Machinery and Steel World*, v. 47, Apr. 1956, p. 102-105.

Multicycling devices for automatic riveting use available machines controlled by electronic mechanisms and programmed tape. Diagrams, photographs. (K13)

251-K. Automatic and Semi-Automatic Welding of Cast Steel With Carbon Dioxide as Inert Protective Gas. V. N. Suslov. *Henry Brutcher Translation No.* 3610, 10 p. (From *Svarochnoe Proizvodstvo*, 1955, no. 1, p. 14-17.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 130-K, 1955. (K1, CI)

252-K. A Semi-Automatic Machine for the Repair Welding of Steel Castings With a Consumable Electrode in a Carbon Dioxide Atmosphere. L. V. Golub. *Henry Brutcher Translation No.* 3611, 8 p. (From *Svarochnoe Proizvodstvo*, 1955, no. 1, p. 17-19.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 131-K, 1955. (K1, CI)

253-K. Electrodes for the Welding of Chrome-Molybdenum Steel. G. A. Ukolov. *Henry Brutcher Translation No.* 3681, 4 p. (From *Svarochnoe Proizvodstvo*, no. 7, 1955, p. 25-26.) Henry Brutcher, Altadena, Calif.

Development and composition of a new electrode coating for welding structural steel. Mechanical properties of weld metal at room tempearture and at 370° C. Tables. 2 ref. (K1, ST)

254-K. (German.) **Shielded Arc Welding of Non-Alloy Steels.** W. Hummitzsch and Fr. Mersmann. *Schweissen und Schneiden*, v. 8, no. 3, Mar. 1956, p. 73-79.

Welding under argon and carbon dioxide, requirements of gases, characteristics and advantages of method, quality of the welded joints, feasibility of the process. Tables, graphs, diagrams, photographs. 16 ref. (K1, CN)

255-K. (German.) **On Hot Cracking of Austenitic Chromium-Nickel-Welds.** Walter Hirsch and Hans Werner Fritze. *Schweissen und Schneiden*, v. 8, no. 3, Mar. 1956, p. 81-85.

Review of present state of knowledge. Table, graph, diagrams, micrographs. 13 ref. (K1, K2, Q26, SS)

256-K. (Russian.) **Study of Attainability of an Equilibrium in Welding With the Aid of Radioactive Tracers.** B. I. Bruk and S. F. Iur'ev. *Svarochnoe Proizvodstvo*, 1956, no. 3, Mar. 1956, p. 1-4.

Use of radioactive sulfur in study of equilibrium in arc welding at 100-250 amperes. Little improvement of equilibrium was gained by increasing welding current. Advantage of electrodes with lower viscosity of slag from flux coating outweigh disadvantage of lower basicity of the coating. Tables, graphs. 10 ref. (K1, S19)

257-K. (Russian.) **Influence of Technology of Welding on the Strength of One-Spot Joints Under a Variable Load.** A. I. Guliaev. *Svarochnoe Proizvodstvo*, 1956, no. 3, Mar. 1956, p. 4-8.

Influence of procedure, defects, spot shape, interstices between sheets and annealing after welding on the cyclic strength of low-carbon steel. Advantages of extra high electrode pressures. Nonadvisability of residual stress-relieving. Interstices between sheets reduce the cyclic strength of spot welds. Tables, graphs, diagrams. 9 ref. (K3, CN)

258-K. (Russian.) **Some Problems in Cold Pressure Welding of Metals.** S. B. Ainbinder. *Svarochnoe Proizvodstvo*, 1956, no. 3, Mar. 1956, p. 8-11.

A pretreatment of welding surfaces; relative advantages of various procedures. Welding of sheets and wires. Diagrams, photographs. 17 ref. (K5)

259-K. (Russian.) **Study of Weldability of 25L Steel.** M. M. Kraichik and N. V. Pashkov. *Svarochnoe Proizvodstvo*, 1956, no. 3, Mar. 1956, p. 17-20.

Attempts to determine optimum welding procedures for 25L steel, widely used in the Soviet railroad industry, to insure close approximation of the properties of the welded joint to those of the basic metals. Tables, graphs, photograph. 1 ref. (K9, ST)

260-K. (Russian.) **Welding of Gears Under a Carbon Dioxide Envelope.** N. N. Belous. *Svarochnoe Proizvodstvo*, 1956, no. 3, Mar. 1956, p. 20-22.

Method of automatic and semi-automatic arc welding of carbon and alloyed steels compared with semi-automatic welding under a layer of flux. The former method is shown to be more effective. Its main advantages are direct observability of the welding process, accuracy of joining and elimination of trimming slag and flux off the joint. Diagrams, photograph, tables. 5 ref. (K1, CN, AY)

261-K. (Russian.) **Welding of Thin-Walled Autoclaves Under Flux.** A. A. Khudoshina. *Svarochnoe Proizvodstvo*, 1956, no. 3, Mar. 1956, p. 23-24.

Procedures and problems in welding portable medical autoclaves. Jigs for securing accurate assembly. Tables, photograph, diagram. (K1, K2, ST)

262-K. Welding and the Structural Steelwork Industry. *British Welding Journal*, v. 3, Apr. 1956, p. 111-118.

Results of survey of the present position of welding in the structural steelwork industry; needs of the industry. Photographs. (K general, T26, ST)

263-K. The Case for Site Welding of Structures. G. H. Smith. *British Welding Journal*, v. 3, Apr. 1956, p. 119-126.

The application of site welding, and how the saving in materials and workmanship can more than compensate for the extra cost at site. Diagrams, photographs. (K1)

264-K. Welding Progress in a General Engineering Workshop. J. A. Edwards and J. O. H. Nice. *British Welding Journal*, v. 3, Apr. 1956, p. 127-134.

Improved welding techniques developed over past 25 years and applied chiefly to the construction of rotary vacuum filters, chemical plants, boilers and diesel engines. Photographs, tables. (K general)

265-K. How to Get More for Your Metalworking Dollar. III. Welding. Rod and Electrode Charts. *Iron Age*, v. 177, Apr. 26, 1956, p. 93-100 + 6 pages.

Welding processes and materials; charts for carbon and stainless steels, aluminum, copper, nickel and magnesium alloys. Photographs, tables. (K general, SS, Al, Cu, Ni, Mg)

266-K. Welding Composite Steels: Clad Steels. Helmut Thielsch. *Machine Design*, v. 28, May 3, 1956, p. 96-100.

Compares clad steels and applied liners; summarizes the welding of clad steels. Diagrams, photographs, tables. 5 ref. (K1, ST)

267-K. New Solders and Fluxes Speed Aluminum's Invasion of Electrical, Plumbing, Air Conditioning Fields. Kenneth V. Lutz. *Modern Metals*, v. 12, Apr. 1956, p. 52-54.

Properties, available forms, applications of aluminum solders. Photographs, tables. (K7, Al)

268-K. Joining Tubes to Tube Sheets for Corrosive Radioactive Chemical Service. W. R. Smith. *Welding Journal*, v. 35, Apr. 1956, p. 307-310.

Suitable joint designs developed for welding tube to tube sheets of heat exchangers where no maintenance repairs can be effected. Diagrams, photographs, tables. (K1, SS)

269-K. How to Use Steel Effectively in Machinery. Omer Blodgett. *Welding Journal*, v. 35, Apr. 1956, p. 311-318.

Welded design makes it possible for the designer to use the right material, in the right amount, in the right place. Photographs, graphs, tables, diagrams. (K1, T general, ST)

270-K. Inert-Arc Consumable-Electrode Welding for Automobile Rear-Axle Housings. E. G. Lommel. *Welding Journal*, v. 35, Apr. 1956, p. 319-325.

Gas metal-arc process was found to be a very satisfactory mass-production tool for carbon steel welding in the automotive industry. Photographs, diagrams. (K1, T21, CN)

271-K. Moisture and Its Effects in Carbon Dioxide Welding of Steel. R. W. Tuthill. *Welding Journal*, v. 35, Apr. 1956, p. 330-333.

Moisture in carbon dioxide has an adverse effect on the ductility of the weld metal. The yield and ultimate strength appears to be unaffected by moisture in the gas, and the increase in spatter can be kept to a minimum by using dry gas. Photographs, tables, radiograph. 4 ref. (K1, Q23, ST)

272-K. Gas-Shielded Consumable-Electrode Welding of 4130 Steel. C. R. Sibley. *Welding Journal*, v. 35, Apr. 1956, p. 334-340.

Standard AISI low-alloy electrode analyses with controlled phosphorus and sulfur contents were found to provide hardenability characteristics in the weld metal similar to those of low-alloy base metal. Photographs, tables, diagram, graphs, micrographs. 5 ref. (K1, T26, AY)

273-K. Properties and Applications of Low-Hydrogen Iron-Powder Electrodes. D. C. Smith, W. G. Rinehart and D. C. Helton. *Welding Journal,* v. 35, Apr. 1956, p. 341-347.

Low-hydrogen electrodes with iron-powder additions to the coatings have been successfully designed for good quality and operation and are commercially available in both titania and lime-type coatings. Photographs, tables, graphs. 4 ref. (K1, Fe)

274-K. Welding Aluminum to Copper Using Inert-Gas Metal-Arc Process. L. A. Cook and M. F. Stavish. *Welding Journal,* v. 35, Apr. 1956, p. 348-355.

Increasing use of aluminum busbar for elevated temperature service in combination with existing copper bus systems has led to the development of this method for braze welding aluminum to copper. Photographs, micrographs, diagrams, graphs, tables. (K1, Al, Cu)

275-K. The Arc Welding of 2.25% Cr-1.0% Mo Alloy Steel Pipe. Jay Bland. *Welding Journal,* v. 35, Apr. 1956, p. 181S-194S.

Investigation shows extent to which thermal treatments are required to obtain satisfactory properties in welded pipe. Tables, graphs, photographs. 7 ref. (K1, AY)

276-K. Inert Shielding Gases for Welding Aluminum. J. D. Dowd. *Welding Journal,* v. 35, Apr. 1956, p. 207S-210S.

Shielding gas containing 50-65% helium, balance argon, found to be superior to argon, helium or other mixtures of argon and helium for both tungsten-arc and consumable-electrode welding of aluminum. Micrographs, graphs. 9 ref. (K1, Al)

277-K. Mechanical Properties of Butt Joints Brazed With BAg-1, BAg-3 and BCu Filler Metals. G. Hansel. *Welding Journal,* v. 35, Apr. 1956, p. 211S-216S.

The room temperature, impact, tensile and fatigue properties of brazed butt joints presented in a manner that will enable proper design of these joints for specific applications. Table, diagrams, graphs, photographs, micrographs, radiographs. 1 ref. (K8, Q7, Q6, Q27)

278-K. CO_2 Inert-Arc Welding Shows Big Cost Advantage. Herb Robinson and Jim McKinney. *Western Metals,* v. 14, Apr. 1956, p. 74-75.

Advantages, procedure, cost factors. Graph, photographs. (K1)

279-K. (Japanese.) **Statistical Study on the Ilmenite Type Arc Welding Electrodes for Mild Steel (Report I). Statistics of Tensile Test Values.** Seiichi Ando and Saburo Mori. *Journal of Railway Engineering Research, (Japan),* v. 13, no. 4, Feb. 25, 1956, p. 93-100.

Analysis of statistical results on tensile strength, yield point, yield ratio, elongation and reduction of area. Graphs, diagrams, tables. 9 ref. (K1, Q27, CN)

280-K. Oxy-Acetylene and Oxy-Propane, a Comparison. II. J. Okladek. *Canadian Metals,* v. 19, Apr. 1956, p. 25-26.

Comparison of heating properties. The amount of heat transferred is calculated. Photograph, table. 2 ref. (K2)

281-K. Use of Standard Positioning Units Can Lower Welding Costs. W. W. Wakefield. *Industry & Welding,* v. 29, May 1956, p. 84-87, 90-92.

By combining two or three standard units and adding a minimum amount of simple tooling, many jobs can be handled with maximum ease and economy. Photographs. (K1)

282-K. Welding Job Made Easier With Dual-Gas Setup. F. K. Mack. *Iron Age,* v. 177, May 3, 1956, p. 104-105.

Argon and carbon dioxide were used on welding practice bombs. Outcome is faster welding, better quality and economy. Photographs. (K1)

283-K. Get Results From the New Iron-Powder Coated Electrodes. Donald B. Howard. *Power,* v. 100, May 1956, p. 80-82, 222.

Complete penetration, low porosity and predetermined ductility level are proved by laboratory tests. Techniques for production or maintenance welding outlined. Tables, graphs. (K1)

284-K. Dip Brazing Boosts Output of Aluminum Assemblies. Donald E. Wernz. *Tool Engineer,* v. 36, May, 1956, p. 83-87.

Details of new applications of this process at the Glenn L. Martin Co. plant, including design, equipment and maintenance. Photographs. (K8, Al)

285-K. Filler Metals for Joining. Orville T. Barnett. *Welding Engineer,* v. 41, May, 1956, p. 46-48.

Development of the E6015 electrode and the E6016 low-hydrogen type. Photograph, tables. 2 ref. (K1)

286-K. Moisture in CO_2 Gas: Its Affect on Mig Welds. R. W. Tuthill. *Welding Engineer,* v. 41, May, 1956, p. 50, 52.

Tests indicate that carbon-dioxide shielded welds can fall below production standards if there is heavy moisture content in carbon dioxide gas. Photographs. (K1)

287-K. Spot Welds Under Stress. John F. Rudy, R. B. McCauley and R. S. Green. *Welding Engineer,* v. 41, May, 1956, p. 91-92.

Indicates a relationship between weld strength and three other parameters: system of failure, macrogeometry of weld cross-section, and observations of a cutaway weld cross-section under stress. Diagram, graph, photograph. (K3)

L

Cleaning, Coating and Finishing

402-L. Properties of Evaporated Metal Films Related to Their Use for Surface Temperature Measurement. Theodore B. Simpson and Charles C. Winding. *A. E. Ch. E. Journal,* Mar. 1956, p. 113-117.

An extension of the understanding of properties of films on glass surfaces has permitted the fabrication of film-resistance thermometers with accuracies as high as 0.01° C. Tables, graphs. 15 ref. (L25, T8)

403-L. Copper Plating With Chemicals on Zinc, Steel and Aluminum. George W. Jorgensen. *American Pressman,* v. 66, Apr. 1956, p. 12, 14.

A new technique performed by applying a copper plating solution to the plate after it has been deep-etched and washed with alcohol. The solution is swabbed over the plate for 3 to 5 min. during which time it chemically plates the image with a thin film of copper. (L17, Cu)

404-L. Electroless Nickel Plating. J. L. Chinn. *Automotive Industries,* v. 114, Apr. 15, 1956, p. 66 + 4 pages.

Process, advantages, applications, design factors and cost considerations. Tables. (L14, Ni)

405-L. Report on Epoxy Resins. *Corrosion,* v. 12, Apr. 1956, p. 187-190.

Application of epoxy resin coatings; coverages; surface preparation; primers; physical properties. Tables. (L26)

406-L. Etching Silver With Chromium Trioxide-Sulfuric Acid Solution. Philip F. Kurz. *Electrochemical Society, Journal,* v. 103, Apr. 1956, p. 257.

Details of procedure to alter the surface of silver to provide a substrate suitable for subsequent surface treatment. Table. (L12, Ag)

407-L. Deposition Conditions and Structure of Compact Metal Electrodeposits. I. Copper Electrodeposits Within the F.T. and U.D. Type Range. J. Elze. *Industrial Finishing,* v. 9, Mar. 1956, p. 438 + 5 pages.

Previously abstracted from original. See item 681-L, 1954. (L17, M27, Q29, Cu)

408-L. Cleaning and Phosphatizing Steel Drums to be Painted. J. M. Raineer. *Industrial Finishing,* v. 32, Apr. 1956, p. 70, 72, 76.

"Jalizing" produces a drum that is completely laundered and dries with a protective coating which increases the adherence and durability of paint surfaces. Photographs. (L12, L14, CN)

409-L. Rubber-Modified Alkyd Sealers for Castings. O. L. Campbell. *Materials & Methods,* v. 43, Apr. 1956, p. 130-131.

These newer finishes have better weather resistance and a lower cost. (L26, CI)

410-L. Some Tips on Electroforming. Marv Rubinstein. *Metal Finishing,* v. 54, Apr. 1956, p. 58-60.

Typical applications in making phonograph record matrices, embossing plates, diamond drills, injection molds and resizing worn components. Photographs. 34 ref. (L18)

411-L. Chromate Conversion Coatings for Copper Alloys. R. Stricklen and E. L. Gabel. *Metal Progress,* v. 69, Apr. 1956, p. 93-96.

A new series of balanced chromate solutions will produce a protective mirror-bright finish on copper and most of its alloys. Chromium can be plated directly to these coatings without an intermediate layer of nickel. Photographs. (L14, Cu)

412-L. Vacuum Metalizing.—A New Development. J. Gordon Seiter. *Plating,* v. 43, Apr. 1956, p. 484-489.

Principles of the process, proper lacquering techniques, equipment required, production cost, advantages and limitations. Photographs. (L25)

413-L. Chromium Plating on Tin-Base Die Castings. *Tin and Its Uses,* 1956, no. 34, p. 4, 16.

Method for preparing and nickel plating die castings made from an alloy of 90% tin, 8½% antimony, 1½% copper so that peeling of chromium plating is prevented. (L17, Sn, Cr, Ni)

414-L. Pretreatment of Uranium for the Application of Ceramic Coatings. C. W. Krystyniak and D. D. Crooks. *U. S. Atomic Energy Commission, Research and Development Report,* KAPL-1340, May 1955, 14 p.

Electropolishing, employing ethylene glycol-ethyl alcohol-phosphoric acid, is a reliable basis for air-firing ceramic coatings. Photographs. (L13, L27, U)

415-L. Plutonium Electropolishing Cell. K. S. Bergstresser. *U. S. Atomic Energy Commission, Research and Development Report,* LA-1106, June 1950, 8 p.

Improvements in apparatus and procedure used in the preparation of bright-surfaced samples of plutonium metal for analytical purposes. Photograph. 1 ref. (L13, Pu)

416-L. Mechanical Descaling of Wire Rod. Clemens H. Eisenhuth. *Wire and Wire Products,* v. 31, Apr. 1956, p. 421-425, 468-470. (Condensed from *Stahl und Eisen,* v. 75, no. 17, Aug. 25, 1955, p. 1092-1099.)

Previously abstracted from original. See item 666-L, 1955. (L10, ST)

417-L. Effect of Liquid Honing Upon the Service Performance of Steel. E. A. Satel and M. A. Elizavetin. *Henry Brutcher Translation No.* 3607, 11 p. (From *Vestnik Mashinostroeniya,* v. 35, no. 2, 1955, p. 51-55.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 255-L, 1955. (L10, ST)

418-L. Electrodeposition of Lead-Tin Alloys. E. Raub and W. Blum. *Henry Brutcher Translation No.* 3631, 11 p. (Abridged from *Metalloberfläche,* v. 9, no. 4, 1955, p. 54A-57A.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 413-L, 1955. (L17, Pb, Sn)

419-L. (Czech.) **Contribution to the Metallography of Zinc Coatings and to Some of Their Faults.** Josef Teindl and Vilém Weniger. *Hutnické Listy,* v. 11, no. 3, Mar. 1956, p. 160-164.

Some faults (zinc peeling, zinc flow down and tearing, development of black spots and of stripes on the sheet, and granular appearance of the coating) investigated by metallography. Diagrams, photographs, micrograph. 20 ref. (L16, M general, Zn)

420-L. (German.) **Influence of Anodizing Variables on the Growth and Various Properties of the Oxide Film.** D. Lenz. *Aluminium,* v. 32, no. 4, Apr. 1956, p. 190-201.

Factors which determine the chemical stability of the film, such as the nature of the corroding medium, the material, the film structure and thickness and sealing; compares bohmite films with anodically produced oxide films. Photographs, graphs, table, micrographs. 23 ref. (L19, Al)

421-L. (German.) **Painting of Steel Structures in Iron and Steel Works.** Lorenz Bierner. *Stahl und Eisen,* v. 76, no. 6, Mar. 22, 1956, p. 335-344.

Factors which determine the life of a paint coat, influence of prescription of definite paint formulas on quality of the paint coat. Graphs, table. (L26, ST)

422-L. (Russian.) **Uses of Oxide Coatings for Electrotechnical Sheet Steel at the Kharkov I. V. Stalin Electromechanical Plant.** Ia. I. Kagan. *Fizika metallov i metallovedenie,* v. 1, no. 2, 1955, p. 374-378.

Oxide coating acts as an insulator film and improves the magnetic properties of steel, cold worked by stamping. Change in coercive force with oxidizing temperature, other relations. Graphs, table. (L14, A5, P16, ST)

423-L. (Spanish.) **Concerning "Pitting" of the Electropolished Surface of Steels.** José Ibarz Aznarez and Sebastian Feliu Matas. *Revista de Ciencia Aplicada,* v. 10, no. 48, Feb. 1956, p. 22-29.

Studies of pitting associated with bubbles occurring on metal surface. Effect of carbide inclusions. Micrographs, diagrams. 6 ref. (L13, R5, ST)

424-L. The Cladding of Zirconium. H. A. Saller, J. R. Keeler and E. R. Szumachowski. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* BMI-717, Dec. 1951, 13 p.

Zirconium was roll clad with nickel, monel, inconel, titanium and an 18-8 stainless steel. With the exception of titanium, all of these metals formed compounds at the zirconium interface and the resulting bonds had poor mechanical properties. Sandwich-type diffusion couples of zirconium with copper, molybdenum, platinum, silver and tantalum indicated that all of these metals formed hard, brittle diffusion products with zirconium. Micrographs. (L22, Zr)

425-L. Electroplating on Zirconium Using Replacement Indium Deposits. W. C. Schickner, J. G. Beach and C. L. Faust. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* BMI-809, Feb. 1953, 15 p.

Nickel plated on replacement-indium-coated zirconium has as-plated adhesion of about 18,000-psi. modulus of rupture. This bond strength is better than the 6000 psi. for as-plated adhesion of nickel on etched zirconium, but is inferior to the 50,000-psi. alloy-bonded nickel (by heat treatment) on etched zirconium. (L17, In, Zr)

426-L. Theory and Practice in Dyeing & Sealing Anodised Aluminum. C. T. Speiser. *Electroplating and Metal Finishing,* v. 9, Apr. 1956, p. 109-116, 128.

Absorption and fixation of dyestuffs; various sealing processes. Diagrams, tables, graphs. 28 ref. (L19, L14, Al)

427-L. A Theory of Adherence of Vitreous Enamels to Aluminium. E. C. Subbarao. *Journal of Scientific & Industrial Research,* v. 15, sec. B, Mar. 1956, p. 150-154.

The surface of an aluminum alloy at various stages of processing and the intermediate layer between the enamel and the metal studied by electron microscopy, X-ray diffraction and X-ray spectroscopy. Photographs, tables. 7 ref. (L27, Al)

428-L. Bright Copper Plating. E. Lutter. *Metal Industry,* v. 88, Apr. 6, 1956, p. 267-269.

Survey of development and present position of bright copper plating. Decision to use this process depends on shape of parts to be plated, nature of basis metal, degree of corrosion protection and surface finish desired. (To be continued.) (L17, Cu)

429-L. Bright Copper Plating. E. Lutter. *Metal Industry,* v. 88, Apr. 13, 1956, p. 293-294.

Precautions necessary to prevent formation of rough deposits; filtering, current reversing, brightening agents; direct nickel plating and plating zinc die-castings. (L17, Cu)

430-L. Carbon Arc Blast Smooths Rough Surfaces. Frank Newberry. *Modern Castings,* v. 29, May 1956, p. 121-122.

Carbon arc-compressed air pad washing reduces grinding and cleaning costs in finishing department of steel foundry. Photographs. (L10, CI)

431-L. Chemical Protective Treatment for Tinplate. Ernest S. Hedges. *Sheet Metal Industries,* v. 33, no. 347, Mar. 1956, p. 173-175, 178.

The chemical treatment, when suitably applied, protects tinplate from blackening by sulfur-bearing products, delays the onset of rusting, provides good base for coating of lacquer or paint. Graph, photographs. (L14, Sn)

432-L. (Russian.) **Periodic Variation of Cathodic Polarization During the Electrodeposition of Lead in the Presence of Surface-Active Substances.** D. N. Gritsan and D. S. Shun. *Doklady Akademii Nauk SSSR,* v. 106, no. 6, Feb. 21, 1956, p. 1035-1038.

Fluctuations in potential explained by the adsorption mechanism underlying the effect of surface-active substances on electrode processes. Graphs, micrograph. 34 ref. (L17, Pb, Cd)

433-L. (Russian.) **Investigation of Cathodic Sputtering in the Near Threshold Region.** I. N. D. Morgulis and V. D. Tishchenko. *Zhurnal Eksperimental'noi i Teoreticheskoi Fiziki,* v. 30, no. 1, Jan. 1956, p. 54-59.

Labelled atoms used to investigate sputtering and to determine magnitude of the sputtering threshold energy. Experimental study using labelled cobalt. Table, graphs. 10 ref. (L25, Co)

434-L. (Spanish.) **Concerning Certain Anomalies in Electrolytic Polishing. I. Crystallizations on Surfaces Polished With Phosphoric Acid and a Mixture of Citric and Sulfuric Acids. II. Patterns and Undulations on Polished Surfaces With Acetic-Perchloric Mixture.** Sebastian Feliu, Manuel Serra and José Antonio Boned. *Instituto del Hierro y del Acero,* v. 9, no. 43, Feb. 1956, p. 213-221.

Crystallization appears under certain conditions developing in electrolytic baths during polishing of steel. Discontinuities in the crystals are evidence of a periodic phenomenon in the electrolytic process. Study of patterns appearing on surface of electrolytically polished steel, possibly due to supersaturation with metallic salt at the anode. Micrographs. 4 ref. (L13, M27, ST)

435-L. Ultra-Modern Production Lines for Steel Drums. *Finish,* v. 13, May, 1956, p. 27-30.

Utilizing principles of automation in manufacturing, 600 lithographed 55-gal. drums are produced hourly in a semi-automatic production system. Photographs. (L26, CN)

436-L. How You Can Brighten Stainless Steel Parts by Electropolishing. W. E. McFee. *Finish,* v. 13, May, 1956, p. 44-46.

Economies of electropolishing in particular cases. Diagrams, graph, photograph. (L13, SS)

437-L. Anodized Aluminum: Rainbow Hues Have "Pot-o'-Gold" Future. W. G. Patton. *Iron Age,* v. 177, May 3, 1956, p. 95-97.

Automobiles, trains, buses, appliances, housewares and buildings find new customer appeal in bright-colored components. New anodizing techniques create finishes that are more resistant to heat, erosion and corrosion .Photographs. (L19, Al)

438-L. Metal Finishing Equipment and Processes. J. L. M. Fletcher. *Metal Industry,* v. 88, Apr. 20, 1956, p. 321-325.

Equipment and processes which have become available in the last 12 months. Progress in automatic electroplating plant, plating barrels, tumbling barrels, liquid abrasive blasting, pickling, bright dipping, new plating processes. Photographs. (L general)

439-L. The Development of Zirconium-Rich Protective Coatings and Brazing Materials for Heat-Resisting Alloys. Alan Blainey. Paper from "Symposium on Metallic Materials for Service at Temperatures Above 1600° F". American Society for Testing Materials, p. 183-193.

Demonstrates feasibility of producing hard protective coatings of zirconium-rich alloys on the surface

of nickel-base alloys and heat-resisting steels. Zirconium alloys show promise as high-temperature brazing materials. Diagrams, micrographs, photographs, tables. 6 ref.
(L16, K8, Zr, Ni, SG-h)

440-L. (German.) **Immersion Aluminum Coating of Iron and Steel Parts.** P. Douady. *Aluminium Suisse,* v. 6, no. 2, Mar. 1956, p. 65-71.

Composition of baths. Equipment and operating procedures. Tables, photographs, micrographs.
(L16, Al, ST)

441-L. (German.) **Mechanism of Electrolytic and Chemical Polishing of Metals, Especially of Nickel.** Willi Machu and Adly Ragheb. *Zeitschrift für Metallkunde,* v. 47, no. 3, Mar. 1956, p. 176-183.

Formation and porosity of oxide layers formed during polishing treatments. Effects of solution concentration and current density on resultant surface smoothness. Graphs, tables. 14 ref. (L12, L13, Ni)

M

Metallography, Constitution and Primary Structures

179-M. An Ultrasonic "Jack Hammer" for Removal of Inclusions. George L. Kehl, Hyman Steinmetz and Warren J. McGonnagle. *Argonne National Laboratory (U. S. Atomic Energy Commission),* ANL-5545, Mar. 1956, 12 p.

Mechanical method for removing inclusions of a minimum diameter of about 10 mu by means of a pointed stylus oscillating at ultrasonic frequencies. The method works well in removing hard and brittle secondary alloy phases and nonmetallic inclusions of either the hard, glassy type or the loose, fluffy kind. Diagram, micrographs, photographs. 7 ref. (M23, M27)

180-M. Method for the Study of Lattice Inhomogeneities Combining X-Ray Microscopy and Diffraction Analysis. S. Weissmann. *Journal of Applied Physics,* v. 27, Apr. 1956, p. 389-395.

Application of the method in establishing the coexistence of various orders of magnitude of substructural entities, in determining their size and disorientation, and in studying the nature of the small angle boundaries and mechanism of deformation. Diagrams. 9 ref. (M22)

181-M. Metallographic Identification of Nonmetallic Inclusions in Uranium. R. F. Dickerson, A. F. Gerds and D. A. Vaughan. *Journal of Metals,* v. 8; *American Institute of Mining and Metallurgical Engineers, Transactions,* v. 206, Apr. 1956, p. 456-460.

Metallographic identification of slag-type inclusions and of the uranium monocarbides, hydrides, dioxides, monoxides and mononitrides in uranium. Micrographs. 4 ref.
(M general, U)

182-M. The Thermal Analysis of Zirconium-Tin Alloys. L. L. Wyman and J. F. Bradley. *Knolls Atomic Power Laboratory (U. S. Atomic Energy Commission),* KAPL-854, Dec. 1952, 9 p.

Several alloys of zirconium containing ½ to 5 wt. % tin studied by dilatometric and thermal analysis, with thermal effects generally confirming the previously proposed zirconium-tin diagram. Tables, graphs. 10 ref. (M23, M24, Zr, Sn)

183-M. The Structure of Solid Solutions. B. L. Averbach. *Massachusetts Institute of Technology Department of Metallurgy (U. S. Atomic Energy Commission),* NYO-7054, Nov. 1955, 36 p.

Sizes of atoms in solution, strain energy, strength, local atomic arrangements, changes in vibrational spectrum in alloy formation. Table, diagram, graphs. 23 ref.
(M26, M25, Q23)

184-M. Microcracks in Case Hardened Steel. A. H. Rauch and W. R. Thurtle. *Metal Progress,* v. 69, Apr. 1956, p. 73-76.

Microcracks occur in high-carbon steels or cases, in number principally dependent on the grain size established by heat treatment, and independent of quenching rate, alloy content, or method of carburizing or carbonitriding. Graph, micrographs, tables. (M27, J28, ST)

185-M. Hexagonal Epsilon Phase in Vacuum-Melted 18% Chrome, 8% Nickel Steels. H. Krainer and E. Krainer. *Henry Brutcher Translation No.* 3668, 3 p. (From *Berg-und Hüttenmännische Monatshefte,* v. 100, no. 7-8, 1955, p. 247-248.) Henry Brutcher, Altadena, Calif.

Micrographic and X-ray structural analyses of 18-8 steel, water quenched from 2280° F. and cold reduced, indicate occurrence of epsilon phase and then of martensite. Table, graphs, micrographs. (M27, AY)

186-M. Etching of Metals in Gas Discharge (By Ionic Bombardment). I. I. Popenova and A. I. Frimer. *Henry Brutcher Translation No.* 3683, 8 p. (From *Zavodskaya Laboratoriya,* v. 21, no. 4, 1955, p. 432-436.) Henry Brutcher, Altadena, Calif.

By positive ion bombardment of the cathode specimen the weakly bonded matter is removed. Table, diagrams, micrographs. 3 ref. (M21)

187-M. (Czech.) **Semi-Automatic Polishing of Metallographic Specimens From Very Hard Materials.** Zdenek Ministr. *Hutnicke Listy,* v. 11, no. 3, Mar. 1956, p. 154-160.

Boron carbide and diamond dust are used. In a special holder, 48 specimens were polished in 50 min. Tables, graph, diagrams, photographs, micrographs. 16 ref.
(M21, EG-d)

188-M. The "Sweeping-Beam" Method of X-Ray Analysis. F. Regler. *Engineers' Digest,* v. 17, Mar. 1956, p. 101-107. (From *Radex Rundschau,* no. 8, Dec. 1955, p. 664-683.)

The advantage of the sweeping-beam method with eccentrically rotated axes is that it increases the number of crystals investigated, without changing the interference patterns caused by the relative crystal orientation. Diagrams. (M22)

189-M. The Crystal Structure of Cr_5Si_3. Carol H. Dauben, D. H. Templeton and C. E. Myers. *Journal of Physical Chemistry,* v. 60, Apr. 1956, p. 443-445.

Observed and calculated structure factors; lattice dimensions of tetragonal crystals. Tables, diagrams. 10 ref. (M26, Si, Cr)

190-M. A Versatile X-Ray Diffractometer for Single-Crystal and Powder Studies. A. R. Lang. *Journal of Scientific Instruments,* v. 33, Apr. 1956, p. 138-141.

Mechanical design, accessories, recording methods. Photograph, diagrams. 11 ref. (M22)

191-M. The Identification and Distribution of Inclusions in Derby and Ingot Uranium. C. M. Schwartz and D. A. Vaughan. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* BMI-272, Aug. 1953, 25 p.

Inclusions identified by X-ray diffraction methods. Metallographic and microradiographic examinations show inclusions concentrated at the top of derby and ingot metal by gravity separation. Uranium carbide inclusions are distributed throughout the ingot metal; amount varies with the temperature maintained during remelt. Micrographs, tables. 4 ref. (M27, U)

192-M. Effect of Irradiation on the X-Ray Line Shape of 2S Aluminum From a Hanford Water Cooling Tube. J. L. Klein and W. B. Nowak. *Massachusetts Institute of Technology (U. S. Atomic Energy Commission),* MIT-1085, May 1952, 24 p.

Measurements of the internal distortions in cold worked and irradiated 2S aluminum made by means of a Fourier analysis of X-ray line shapes. Fourier coefficients yield quantitative values for the r.m.s. distortions produced by cold work and by cold work plus irradiation. Graphs. 3 ref. (M22, Al)

193-M. (Russian.) **Electronographic Determination of the Structure of $Tl_2Sb_2Se_4$.** Z. G. Pinsker, S. A. Semiletov and E. N. Belova. *Doklady Akademii Nauk SSSR,* v. 106, no. 6, Feb. 21, 1956, p. 1003-1006 + 1 plate.

Electron diffraction study of complex metallic layers. Electronograms obtained from sublimated layers of the pseudo-binary system T_2Se-Sb_2Se_3. Texture and orientation of crystallites. Micrograph, diagrams, photograph. 1 ref. (M26, Se, Tl, Sb)

194-M. (Russian.) **Investigation of Inclusions of the Oxide-Film Type in Aluminum Alloy Forgings.** I. N. Fridliander. *Doklady Akademii Nauk SSSR,* v. 107, no. 1, Mar.-Apr. 1956, p. 122-124.

Distribution of films and their microstructure, role of impurities, effect of sliding of layers during forging or pressing operations. Micrographs, table, diagram.
(M27, F22, Al)

195-M. (Russian.) **Effect of Heating Rate on the Fine Structure of Chromium Steel.** I. N. Kidin. *Izvestiia Akademii Nauk SSSR, Otdelenie, Khimicheskikh Nauk,* 1956, no. 2, Feb. 1956, p. 26-34.

Effect of heating rate on size of coherent zones and hardness after quenching. Relation of temperature, heating rate and alloy composition to dimensions of mosaic blocks. Variation in size of austenitic formations along boundaries of coherent zones. Tables, graphs, diagram. 5 ref. (M26, M27, J general, Q29, AY)

196-M. (Russian.) **Crystals in Science and Technology.** A. V. Shubnikova. *Vestnik Akademii Nauk SSSR,* v. 26, no. 3, Mar. 1956, p. 37-52.

Main trends in the science of crystallography; relationship to other sciences. Types of crystal growth, methods of studying crystallographic phenomena. Photographs, micrographs. (M26)

197-M. (Spanish.) **Oxidation in Air of Iron Alloys Used as Metallographic Reagents.** Antonio Scortecci and C. Durand. *Instituto del Hierro y del Acero,* v. 9, no. 43, Feb. 1956, p. 169-175.

Color metallography of iron alloys consists of oxidation in air of metallographic specimens mechanically or electrolytically polished to remove the hard surface layer. Applications of the method to stainless steel, manganese steel, spheroidal cast iron and to the study of plastic deformations and recrystallization phenomena. Table. 42 ref.
(M23, N5, R3, SS, AY, Cl)

198-M. (Ukrainian.) **Structure of the Liquid Eutectic Bi-Pb Alloy in the Light of X-Ray Structural Analysis.** A. F. Skryshevs'kyi. *Dopovidi Akademii Nauk Ukrains'koi RSR,* 1956, no. 1, p. 62-66.

X-ray intensity curves show steric patterns of pure bismuth and pure lead. Graphs. 6 ref. (M26, Bi, Pb)

199-M. (Ukrainian.) **Crystal Structure of Ternary Compounds in Mn-Co-Si and Mn-Ni-Si Systems.** E. I. Gladyshevs'kyi, P. I. Kryp'iakevich and Iu. B. Kuz'ma. *Dopovidi Akademii Nauk Ukrains'koi RSR,* 1956, no. 1, p. 67-71.

X-ray and microstructural analysis of ternary compounds of the $MgZn_2$ structural type found in these systems. Isostructural properties of manganese and magnesium compounds. Tables. 12 ref. (M26, M27, Co, Si, Mg, Mn, Si)

200-M. A Model Metallographic Laboratory. II. S. J. Majka. *Canadian Metals,* v. 19, Apr. 1956, p. 56, 5 pages.

Design, layout and equipment of laboratory which will accommodate 25 workers without crowding or congestion in a floor space of 2500 sq. ft. Diagrams, photographs. (M general)

201-M. Investigations on the Microstructure of Uranium-Replication, Cathodic Vacuum Etching, and Optical and Electron Microscopy. T. K. Bierlein. *Hanford Atomic Products Operation (U. S. Atomic Energy Commission),* HW-34390, Jan. 1955, 35 p.

Various methods and techniques applicable to the study of fine microstructural details in radioactive specimens. Utility and quality of cathodic vacuum etching as a means for attaining a clean, etched surface demonstrated by micrographs of a variety of nonirradiated uranium specimens and their replicas. Diagrams, micrographs, photographs. 6 ref. (M21, M23, U)

202-M. The Equilibrium Diagram of the System Aluminium-Silicon. H. W. L. Phillips. *Institute of Metals, Annotated Equilibrium Diagrams, No.* 16, Nov. 1955, 3 p.

Includes numerical data and notes. Table, phase-diagram. 20 ref. (M24, Al, Si)

203-M. The Equilibrium Diagram of the System Aluminium-Beryllium. H. W. L. Phillips. *Institute of Metals, Annotated Equilibrium Diagrams, No.* 19, Feb. 1956, 4 p.

A large-scale diagram with accompanying table and notes. Tables, phase diagram. 8 ref. (M24, Al, Be)

204-M. The Equilibrium Diagram of the System Aluminium-Cobalt. H. W. L. Phillips. *Institute of Metals, Annotated Equilibrium Diagrams, No.* 20, Feb. 1956, 5 p.

A large diagram of the system with auxiliary table and notes. Table, phase diagram. 12 ref. (M24, Al, Co)

205-M. The Equilibrium Diagram of the System Aluminium-Silver. H. W. L. Phillips. *Institute of Metals, Annotated Equilibrium Diagrams, No.* 21, Feb. 1956, 5 p.

Large diagrams of the system with accompanying tables and notes. Tables, phase diagrams. 20 ref. (M24, Ag, Al)

206-M. The Equilibrium Diagram of the System Aluminium-Titanium. H. W. L. Phillips. *Institute of Metals, Annotated Equilibrium Diagrams, No.* 22, Feb. 1956, 5 p.

A large diagram with table and notes. Table, phase-diagram. 6 ref. (M24, Al, Ti)

207-M. The Uranium-Mercury System. D. H. Ahmann, R. R. Baldwin and A. S. Wilson. *Iowa State College, Ames Laboratory (U. S. Atomic Energy Commission),* CT-2960, Oct. 1945, 27 p.

The system has been studied by thermal analysis, vapor pressure-temperature curves and X-ray diffraction. There appears to be some solubility of uranium in mercury and of mercury in uranium but no mutual solubility between the compounds. Because of the pyrophoric nature of the amalgams, all work was done under vacuum or an inert atmosphere. Diagrams, graphs, tables. 16 ref. (M24, N12, U, Hg)

208-M. Intersection Faulting Mechanism Theory of Flow and Fracture of Face-Centered Cubic Metals. Robert B. Green. *Physical Review,* v. 102, ser. 2, Apr. 15, 1956, p. 376-380.

Intersection of any dislocation avalanche with a stationary dislocation having a Burgers vector component normal to the slip plane is shown to produce a close-packed partial plane of vacancies or interstitials in the slip plane and intrinsic or extrinsic faults for 111 slip planes. Explanation of preference for slip of 111 planes and X-ray evidence are given. Diagrams, graphs. 13 ref. (M26, Q24)

209-M. High-Temperature Microscopy. H. N. Baumann. Paper from "High-Temperature Technology". John Wiley & Sons. p. 484-490.

Construction and operation of a microscope assembly whose optical elements are designed for studies of high-temperature phenomena in the general range of 1500° C. and upwards. Micrographs, photographs. 6 ref. (M21)

210-M. High-Temperature X-Ray Diffraction. F. Schossberger. Paper from "High-Temperature Technology". John Wiley & Sons. p. 490-500.

Recent developments in the field, in terms of apparatus, techniques, applications. Diagrams, table. 74 ref. (M22)

211-M. (English.) **Electron-Diffraction Study of the Structure of Supercooled Liquid Bismuth.** Mieko Takagi. *Physical Society of Japan, Journal,* v. 11, no. 4, Apr. 1956, p. 396-405.

Thin bismuth films were prepared on crystal surfaces by evaporation and the liquid state of the films at temperatures above and below the ordinary melting point (271° C.) were studied by means of the reflection method of electron diffraction. Tables, graphs, diffractograms. 17 ref. (M26, M22, Bi)

212-M. (French.) **Study of Grain Boundaries and Substructures in Steels.** L. Habraken and P. Cuvelier. *Métaux, Corrosion-Industries,* v. 31, no. 367, Mar. 1956, p. 105-125.

Electron metallographic study in pure iron, carbon steel and alloy steels. Examination of growth during interrupted isothermal and anisothermal treatments. Influence of annealing and high-temperature creep tests. Diagrams, micrographs. 12 ref. (M27, J general, Q3, Fe, ST)

213-M. (German.) **Production and Hardening of Cobalt-Nickel-Zinc Alloys.** Werner Köster, Heinz Schmid and Ezatollah Dahesh. *Zeitschrift für Metallkunde,* v. 47, no. 3, Mar. 1956, p. 165-171.

The phase diagram of sintered cobalt-nickel-zinc alloys (containing 15 to 60% zinc) is set up by means of microscopic, X-ray and magnetic investigations. The alloys show magnetic and mechanical age hardening. Diagrams, tables, micrographs, graphs. 9 ref. (M24, N7, Co, Ni, Zn)

214-M. (German.) **Auxiliary Means for Metallographic Work and Demonstration.** Roland Mitsche. *Zeitschrift für Metallkunde,* v. 47, no. 3, Mar. 1956, p. 171-175.

Equipment and attachments which will facilitate metallographic investigation including a binocular eyepiece with indicator, micrometer eyepiece for determining grain size, and magnetic microscope stage. Photographs, diagrams. 3 ref. (M21)

215-M. (German.) **Application of Radioactive Methods to Metallographic Problems (Autoradiography).** G. Glawitsch. *Zeitschrift für Metallkunde,* v. 47, no. 3, Mar. 1956, p. 199-202.

Owing to the high velocity of α and β-particles during nuclear disintegration, as well as the nature of the γ-radiation, the method of autoradiography produces a blackening of the reproductive photographic material which is not exactly confined to the spot of the source of radiation. This reduction in resolving power may be balanced successfully by the transfer printing method. Diagrams, graph, autoradiographs. 12 ref. (M23)

216-M. (Russian.) **Ultraviolet Metallographic Microscope.** T. G. Porokhova. *Zavodskaia Laboratoriia,* v. 22, no. 3, Mar. 1956, p. 336-340 plus 1 plate.

Optical arrangement of microscope, types of screens and light filters, method of using the apparatus, contrast between micrographs with this and the usual microscopes. Micrographs, photographs, tables, diagram, graph. (M21, Ni, Al, Zn, Pb-h)

217-M. (Russian.) **Separation of Cementite From Titanium Carbide.** N. M. Popova and M. F. Rybina. *Zavodskaia Laboratoriia,* v. 22, no. 3, Mar. 1956, p. 274-275.

Method includes selective solution of one of the phases to a mixture of carbides containing cementite and titanium carbide. Tables. 2 ref. (M23, Ti, ST)

218-M. (Book-German.) **Theoretical Metallography.** Ulrich Dehlinger. 250 p. 1955. Springer-Verlag, Berlin; Göttingen, Heidelberg.

Crystallographic fundamentals; electronic and crystal structure in the periodic system. Heat of composition and lattice structure of alloys. Physical properties of elements and alloys. Phase equilibrium and reaction kinetics. (M general, N general, P general)

N

Transformations and Resulting Structures

192-N. The Effect of Cycling Variables Upon the Growth Rate of 300° C. Rolled Uranium. R. M. Mayfield. *Argonne National Laboratory (U. S. Atomic Energy Commission),* ANL-4905, June 1952, 26 p.

Variables studied include heating and cooling rates, cycling temperature limits, temperature range and holding times at each temperature. Diagram, graphs, photograph, tables. 11 ref. (N3, U)

193-N. Orientations of Large Grains Produced by Strain-Anneal Treatment of High Purity Uranium. E. S. Fisher. *Argonne National Laboratory (U. S. Atomic Energy Commission),* ANL-5075, May 1953, 16 p.

Orientations of 16 large grains, which were produced in a rod of high-purity uranium in an attempt to prepare a single crystal by the strain-anneal method, were determined using back-reflection Laue photograms. Diagrams, graph, micrographs, table. 7 ref. (N5, U)

194-N. Preparation of Alpha Uranium Single Crystals. III. Grain Coarsening Method. E. S. Fisher. *Argonne National Laboratory (U. S. Atomic Energy Commission),* ANL-5021, Final Report, Aug. 1954, 89 p.

Investigation of coarsening in uranium containing a uniformly dispersed inhibitor and the results of introducing an inhibitor gradient. Heat treatments used for preparing single crystals of diameters varying from 0.140 to 0.175 in. from four different materials. Diagrams, graphs, micrographs, photographs, tables. 8 ref. (N12, N3, U)

195-N. Transformation Kinetics of Eutectic Uranium-Chromium Alloy. H. A. Saller, F. A. Rough and A. A. Bauer. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* BMI-869, Sept. 1953, 19 p.

Uranium and eutectic uranium-chromium alloy were studied during heating at rates up to 650 to 780 c.p.s. respectively. Tables, graphs. 3 ref. (N6, Cr, U)

196-N. Inhibition of Grain Growth. (Digest of "The Effect of Aluminum Nitride Precipitation in Relation to Grain Growth in Steels", by A. B. Chatterjea and B. R. Nijhawan; presented at the annual meeting of the Indian Institute of Metals in Jan. 1955, 25 p.) *Metal Progress,* v. 69, Apr. 1956, p. 142-144.

Investigation of various type steels to determine effect of aluminum in grain growth inhibition; theory and explanation is based on aluminum nitride. (N3, N7, ST)

197-N. Stabilization of Metal Carbides by Nonmetallic Elements. Harry H. Podgurski. Paper from "Engineering Research Laboratory 1953-1954". v. I, 1954. E. I. DuPont de Nemours & Company, Wilmington, Del., p. 153-164.

Proposes that both sulfur and oxygen may readily inhibit the decomposition of iron, cobalt and nickel carbides by blocking the nucleation of graphite at the surface of these powder composites. Micrographs, tables. 17 ref. (N8)

198-N. Nucleation-and-Growth Processes in Metals and Alloys. H. K. Hardy and T. J. Heal. Paper from "Symposium on the Mechanism of Phase Transformations in Metals". Institute of Metals. p. 1-46 + 4 plates.

Examples of the thermodynamic-composition relationships underlying typical nucleation processes are used to show that the initial reaction may always be treated as part of a precipitation process. Current information on the effect of plastic deformation on nucleation processes reveals a field ready for active exploration. Diagrams, graphs, tables. 194 ref. (N2, Q24, Al)

199-N. Superlattice Formation in the Alloy $CdMg_3$. H. Steeple and H. Lipson. Paper from "Symposium on the Mechanism of Phase Transformations in Metals". Institute of Metals. p. 77-85 + 1 plate.

Optical-diffraction method of illustrating the process of superlattice formation in alloys; its application to $CdMg_3$ and some examples of diffraction patterns. Diagrams. 18 ref. (N10, Cd, Mg)

200-N. The $\beta \rightarrow \alpha$ Transformation in Pure Tin and Its Dilute Alloys. E. O. Hall. Paper from "Symposium on the Mechanism of Phase Transformations in Metals". Institute of Metals. p. 87-92 + 1 plate.

Study of the mechanism whereby gray (α) tin disintegrates into small pieces as a result of the volume change on transformation. Diagram, tables. 11 ref. (N6, Sn)

201-N. Sigma-Phase Nucleation and Other Transformations During Diffusion in the Iron-Chromium System. H. J. Goldschmidt. Paper from "Symposium on the Mechanism of Phase Transformations in Metals". Institute of Metals. p. 105-119.

X-ray analysis was used to study the progress of diffusion in powder compacts of iron and chromium for various temperatures, times and compositions. It has been possible to determine in this way the rate of solid-solution formation. Diagram, graphs, tables. 13 ref. (N1, N2, SS)

202-N. Martensitic Transformations. B. A. Bilby and J. W. Christian. Paper from "Symposium on the Mechanism of Phase Transformations in Metals". Institute of Metals. p. 121-172.

Available crystallographic and kinetic data for all transformations of this type reviewed. An account is given of recent theories of the crystallography of martensite, and the assumptions and predictions which they involve are compared. Diagrams, tables. 166 ref. (N8, N9, ST)

203-N. (English.) **Equilibrium of Carbon and Oxygen in Molten Iron Saturated With Carbon.** Sachio Matoba and Shiro Banya. *Technology Reports, Tohoku University,* v. 20, no. 1, 1955, p. 131-141.

Equilibrium relationships determined. Graphs, tables, diagram. 14 ref. (N14, Fe)

204-N. (Czech.) **Contribution to the Question of Brittleness of Transformer Sheets.** Vaclav Rauner and Marcela Zezulova. *Hutnické Listy,* v. 11, no. 3, Mar. 1956, p. 134-139.

Brittleness of transformer sheets is due to the formation of a hard and massive precipitate which occurs mostly in alpha grain boundaries. Cause of this formation described. Tables, micrographs. 11 ref. (N7, N1, Q23, SG-p)

205-N. (Czech.) **About the Morphology of Brittle Constituents in Transformer Sheet Structure.** Jaroslav Jezek. *Hutnické Listy,* v. 11, no. 3, Mar. 1956, p. 139-143.

Concludes that the solution of the nonferrous phase in steel with 4% silicon occurs with the discontinued shifting of the ferrite phase boundary so that parallel zones with variable composition are formed which manifest themselves after the etching. Graph, micrographs. 8 ref. (N7, N12, SG-p)

206-N. (Czech.) **Activation Energy of Viscosity and of Self-Diffusion in Fused Metals.** Antonin Hrbek. *Hutnické Listy,* v. 11, no. 3, Mar. 1956, p. 164-168.

Properties of metals in molten state. Calculation of viscosity and self-diffusion in molten metals at an arbitrary temperature. Table, graphs. 44 ref. (N1, P12)

207-N. (Russian.) **X-Ray Study of Reaction Diffusion in a System of Copper and Sulfur.** V. I. Arkharov and S. Mardeshev. *Fizika Metallov i Metallovedenie,* v. 1, no. 2, 1955, p. 273-280 + 2 plates.

Phase composition of outer, middle and inner layers of scale formed as high-temperature reaction products between a solid metal and a gaseous medium. Microstructure of sulfides formed. Mechanism of corrosion by gas. Tables, X-ray diffractograms, micrographs, photograph. 18 ref. (N1, R9, M27, Cu)

208-N. Kinetics of the Zirconium-Nitrogen and Zirconium-Tin-Nitrogen Systems. M. W. Mallett, J. Belle and B. B. Cleland. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* BMI-829, May 1953, 30 p.

A study in the temperature range of 920 to 1640° C. at 1 atmosphere pressure. The reaction of nitrogen with zirconium or zirconium-tin alloys follows a parabolic law after an initial induction period. Presence of small amounts of tin as an alloy constituent appears to retard the over-all reaction rate. Graphs, tables. 17 ref. (N15, P13, Sn, Zr)

209-N. Foundry Practice. XI. Heat Treatment. William H. Salmon and Eric N. Simons. *Edgar Allen News,* v. 35, Apr. 1956, p. 82-84.

Crystalline structure of cast copper alloys; stress-relief and annealing; annealing treatments producing malleabe irons. (To be continued.) Table, micrographs. (N8, J23, J1, CI, Cu)

210-N. Carbide Phase Changes on Tempering a Molybdenum Steel. K. Kuo. *Engineers' Digest,* v. 17, Mar. 1956, p. 95-98. (From *Jernkontorets Annaler,* v. 140, no. 1, 1956, p. 24-46.)

An account of the microstructural changes accompanying the carbide conversion $Fe_3C \rightarrow Mo_2C$, as revealed under optical and electron microscopes. Micrographs. 7 ref. (N8, J29, M27, AY)

211-N. The Solubility of Graphite in Manganese, Cobalt, and Nickel. E. T. Turkdogan, R. A. Hancock and S. I. Herlitz. *Iron and Steel Institute, Journal,* v. 182, Mar. 1956, p. 274-277.

Solubility determined at various temperatures up to 1700° C. Graphs, table. 34 ref. (N12, Mn, Co, Ni)

212-N. Some Effects of Heat Treatment and Microstructure on the Transition Temperature of a 0.24% Carbon Steel. G. Burns and C. Judge. *Iron and Steel Institute, Journal,* v. 182, Mar. 1956, p. 292-300.

Austenite grain size at the commencement of cooling is a major factor affecting the transition temperature. Cooling rate also has a substantial effect which is more marked during the transformation of the pearlite than in other parts of the cooling range. Graphs, micrographs. 6 ref. (N8, J general, CN)

213-N. Some Defects in Crystals Grown From the Melt. I. Defects Caused by Thermal Stresses. E. Billig. *Royal Society, Proceedings,* v. 235, ser. A, Apr. 10, 1956, p. 37-55 + 8 plates.

Investigation of residual imperfections of crystals formed during their growth from the melt. The crystal is assumed to have solidified in the form of a perfect lattice but to be subsequently deformed by the action of some mechanical stress. Diagram, graphs, photographs, micrographs, table. 23 ref. (N12)

214-N. (French.) **A Study of Polygonization Phenomena and Their Practical Applications.** Jean Talbot. *Chimie & Industrie,* v. 75, no. 3, Mar. 1956, p. 509-518.

The development of micrographic and radiocrystallographic methods has made it possible to observe a new physical state of metals named the polygonized state. Micrographs, photographs, graph, diagrams. 18 ref. (N5)

215-N. (French.) **Kinetics of Precipitation in an Aluminum-Copper Alloy**

With 4% Copper. Francois Sebilleau. *Comptes Rendus,* v. 242, no. 11, Mar. 12, 1956, p. 1467-1468.

Application of the method of the displacement of diffraction rays to the study of the evolution of non-homogeneous solid solutions makes it possible to distinguish between the phenomena of pre-precipitation and ordinary precipitation. Graph. 2 ref. (N7, Cu, Al)

216-N. (Polish.) **New Device for Magnetometric Examination of the Kinetic Energy of Martensitic Transformation in Steel at Temperatures Below the Temperature of the Surrounding Medium.** W. Cias. *Prace Instytutow Ministerstwa Hutnictwa,* v. 8, no. 1, 1956, p. 1-16.

Measurement of magnetic saturation of test specimens which increases with the growth of the ferromagnetic phase (martensite). Graphs, diagrams, photographs, micrographs. 57 ref. (N8, P16)

217-N. (Russian.) **Mechanism of Austenite Formation With Rapid Heating.** I. N. Kidin. *Doklady Akademii Nauk SSSR,* v. 106, no. 6, Feb. 21, 1956, p. 1019-1022.

Thermal and dilatometric curves for various heat treated technically pure iron specimens. Manner in which austenite forms along boundaries of mosaic blocks. Microhardness at edge and within ferritic field of steel after heat treatment. Graphs, diagrams. 18 ref. (N8, Q29, J general, ST)

218-N. (Russian.) **Investigation of the Fine Crystal Structure of the γ-Phase Stabilized by Reversed Martensitic Transition.** Ia. M. Golovchiner and R. A. Landa. *Doklady Akademii Nauk SSSR,* v. 107, no. 1, Mar.-Apr. 1956, p. 67-70.

Relation between variation in crystalline state of γ-phase and its capacity for transformation (γ→d) during and following cooling. Relation between mosaic block sizes and heating temperature after normal and reverse martensitic transformations. Theories as to causes of stabilization. Role of plastic deformation. Graphs, table. 3 ref. (N8, Q24, AY)

219-N. (Russian.) **Investigations of Certain Physical Processes Occurring on the Surface of a Metal at High Temperature. II. Recrystallization in the Surface Layer of the Metal.** Ia. E. Geguzin and N. N. Ovcharenko. *Izvestiia Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk,* 1956, no. 2, Feb. 1956, p. 3-14.

Experimental study of grain recrystallization kinetics of a polycrystalline specimen of copper. Natural roughness on specimen surface increases grain stabilization time. Relation between thickness of surface layer formed and average grain size. Micrographs, table, graph, diagram. 5 ref. (N5, M27, Cu)

220-N. (Russian.) **Causes of Lowered Properties of Bessemer Steel and Possible Means of Eliminating Them.** P. P. Arsent'ev, S. I. Filippov and V. V. Iakovlev. *Izvestiia Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk,* 1956, no. 2, Feb. 1956, p. 15-25.

Effect of nitrogen, oxygen and carbon (depending on amount) in causing aging, brittleness and unsatisfactory electro-weldability. Microstructural studies reveal phases within ferritic grain. Melting techniques recommended include surface oxygen blowing in the converter and neutralization of harmful impurities. Tables, graphs, photographs. 8 ref. (N7, M27, Q23, K9, ST)

221-N. (Russian.) **Growth of the Carbide Phase During Heat Treatment of Steel.** V. I. Psarev. *Metallovedenie i Obrobotka Metallov,* 1956, no. 2, Feb. 1956, p. 2-8.

Relation between average radius or number of coarsening particles and the period of time of isothermal soaking. Linear character of rate of grain growth. Relation between surface energy at phase boundaries and the "coagulation" process. Effect of alloying elements and temperature. Tables, graph. 8 ref. (N3, N5)

222-N. (Russian.) **Investigation of the Isothermal Annealing of Some Alloy Steels.** E. S. Tovpenets. *Metallovedenie i Obrabotka Metallov,* 1956, no. 2, Feb. 1956, p. 53-56.

Magnetometric and microstructural methods of analysis. Effect of austenization temperature; cooling procedure, media, and time; length of soaking. Recommendations for suitable annealing procedures for different steels. Tables, graphs. 3 ref. (N8, J23, AY)

223-N. **Preparation of Alpha Uranium Single Crystals. I. Phase Transformation Method.** E. S. Fisher. *Argonne National Laboratory (U. S. Atomic Energy Commission),* AECD-3798, Nov. 1953, 39 p.

Method investigated was a modification of the Bridgman technique for growing single crystals from a melt. Description of structures produced by this treatment, summary of indicated effects of variables on the structures. Diagrams, graph, micrographs, photographs. 11 ref. (N12, U)

224-N. **Vibration Suppresses Columnar Grain Growth of Aluminum.** D. W. Levinson, A. H. Murphy and W. Rostoker. *Light Metal Age,* v. 14, Apr. 1956, p. 24-25.

Some experiments which graphically illustrate the magnitude of this effect. Photographs, table, diagram. 3 ref. (N12, N3, Al)

225-N. **Alloying Theory.** R. W. Buzzard. *National Bureau of Standards (U. S. Atomic Energy Commission),* NBS-4032, Apr. 1955, 14 p.

Search for valid physical data. It was shown that the ionic parameters may be applied to solubility data for binary alloy systems. An approach to the problem of polyvalent metals on a reasonable basis using precise data was developed. Diagram, graph, tables. (N general)

226-N. (Czech.) **Tempering in Liquid Medium and Gaseous Atmosphere.** Zdenek Hostinsky. *Slévarenství,* v. 4, no. 3; *Prace Ceskoslovenského Vyzkumu Slévarenského,* v. 3, no. 29, Mar. 1956, p. 203-212.

Graphitization studies in salt baths and protective atmospheres. Effects of processing factors and composition of the cast iron. Photograph, diagram, micrographs, tables, graphs. 9 ref. (N8, J23, CI)

227-N. (German.) **Diffusion Investigation by Means of Ferromagnetic Suspension.** Karl Torkar and Hans H. Weitzer. *Zeitschrift für Metallkunde,* v. 47, no. 3, Mar. 1956, p. 191-194.

A method by means of which the boundaries between a magnetic and a nonmagnetic area may be made visible with the aid of a magnetic suspension which accumulates at the boundaries during the process of magnetization. The investigation of the diffusion of copper and nickel is given as an example. Photographs, micrographs, graph. 7 ref. (N1, P16, Cu, Ni)

228-N. (German.) **Hardening Effect in Rolled Zinc Alloys.** Erich Pelzel. *Zeitschrift für Metallkunde,* v. 47, no. 3, Mar. 1956, p. 195-198.

Cold rolled binary zinc alloys containing low quantities of aluminum, copper, silver and cadmium do not show a hardening effect. In the case of ternary alloys (Zn-Al-Cu, Zn-Cu-Ag, Zn-Ag-Cd, Zn-Cu-Cd) the decrease of hardness by crystal recovery during aging at room temperature is markedly delayed; this is interpreted as an age hardening effect. Graphs, micrographs. 10 ref. (N7, Q24, Zn)

229-N. (German.) **Self-Diffusion in Molten Indium Metal.** A. Lodding. *Zeitschrift für Naturforschung,* v. 11a, no. 3, Mar. 1956, p. 200-203.

Diffusion coefficient "D" of liquid indium determined in the range of 170 to 750° C. by capillary method. Results can be expressed as follows: $D = 28.9 \times 10^{-5} \exp. (-2430/RT)$ Table, graph, diagram. 5 ref. (N1, In)

230-N. (Russian.) **Determination of Residual Austenite in High-Speed Steel by the Magnetic Method.** A. I. Gardin. *Zavodskaia Laboratoriia,* v. 22, no. 3, Mar. 1956, p. 303-309.

Carbide-phase content after various heat treatments. Variation of carbide phase in relation to temperatures of quenching and tempering. Equations. Graphs, tables. 4 ref. (N8, M23, J26, J29, TS)

231-N. (Russian.) **Use of Magnetic Method for Studying Phase Transformations in Alloys Having Two Ferromagnetic Phases.** Iu. D. Tiapkin. *Zavodskaia Laboratoriia,* v. 22, no. 3, Mar. 1956, p. 309-311.

Use of nomograms and equations. Variation in magnetic absorption of the given phase with respect to temperature. Martensitic transformations. Graphs. (N8, M23, Fe, Ni)

232-N. (Russian.) **Anisometric Sensitivity and Experimental Error in the Study of Phase Transformations.** K. A. Malinina. *Zavodskaia Laboratoriia,* v. 22, no. 3, Mar. 1956, p. 312, 314.

Determinations of residual austenite. Graphs, tables. 2 ref. (N8, AY)

233-N. (Russian.) **Scale of Microstructures of Martensite.** A. P. Guliaev, A. A. Kolesanova and E. I. Malinkina. *Zavodskaia Laboratoriia,* v. 22, no. 3, Mar. 1956, p. 314-315 and 2 plates.

Use of scale for size and type (e.g., needle-like formations) of martensitic microstructure in determining optimum heating temperatures for induction hardening and other heat treatments. Micrographs, table. (N8, M27, J general, AY)

234-N. (Book.) **Symposium on the Mechanism of Phase Transformations in Metals.** 276 p. 1955. The Institute of Metals, 4 Grosvenor Gardens, London, S. W. 1, England.

Eighteen papers covering austenitic, martensitic and other transformations in ferrous and nonferrous metals and alloys. (N general, Fe, EG-a)

P

Physical Properties and Test Methods

235-P. **The Solubility of Uranium in Fused Hydroxides.** J. W. Droege, M. J. Snyder and R. B. Filbert, Jr. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* BMI-928, July 1954, 27 p.

Solubilities in molten hydroxides of sodium and lithium measured by

filtering mixtures containing an excess of uranium. The molten mixtures were held in a nickel container and filtered through graphite filters, using controlled atmospheres of argon and hydrogen. Diagrams, graphs, tables. (P13, N12, U)

236-P. Electrolytic Shaping of Germanium and Silicon. A. Uhlir, Jr. *Bell System Technical Journal,* v. 35, Mar. 1956, p. 333-347.

Properties of electrolyte-semiconductor barriers with emphasis on germanium; use of these barriers in localizing electrolytic etching. Other localization techniques, electrolytes for etching germanium and silicon. Diagrams, graphs, photographs. 16 ref. (P15, L12, Ge, Si)

237-P. Diffusion Effects in Drift Mobility Measurements in Semiconductors. J. P. McKelvey. *Journal of Applied Physics,* v. 27, Apr. 1956, p. 341-343.

Drift mobility measurements in semiconductors using small steady d.c. fields. Measurements of transit times vs. sweep field show that the diffusion corrections are in agreement with experiment. Diagrams, graphs. 9 ref. (P15, N1)

238-P. Review of the Effects of Hydrogen in Steel. E. R. Slaughter. *Journal of Metals,* v. 8, Apr. 1956, p. 430-431.

Hydrogen retained in steel may result in important defects, particularly in heavy sections of killed carbon and alloyed steels. Graphs. 3 ref. (P10, ST)

239-P. The Use of Cyclotron Irradiation in the Study of Radiation Effects on Materials; Techniques Developed Since 1952. William S. Gilbert and Alan Andrew. *North American Aviation, Inc. (U. S. Atomic Energy Commission),* NAA-SR-1477, Mar. 1956, 16 p.

Details of methods covering both metals and graphite over a temperature range of irradiation from −196 to +500° C.; details of an instantaneous cyclotron. Diagrams, photograph. (P10)

240-P. Hall Effect and Magnetic Properties of Armco Iron. Simon Foner. *Physical Review,* v. 101, ser. 2, Mar. 15, 1956, p. 1648-1652.

The effect is given by a sum of the ordinary and the extraordinary effect over the range investigated, including the nonlinear region. Shows that the extraordinary Hall constant is independent of field within the experimental error. Graphs, tables. 20 ref. (P15, P16, Fe)

241-P. Photoemission From Silver Into Sodium Chloride, Thallium Chloride, and Thallium Bromide. W. J. Turner. *Physical Review.* v. 101, ser. 2, Mar. 15, 1956, p. 1653-1660.

Photoelectric work function for the transfer of electrons from a clean metal surface directly into an insulating crystal lattice. Diagrams, graphs. 20 ref. (P15, Ag)

242-P. (German.) **Semi-Conductivity Properties of $ZnAs_2$.** C. Fritzsche. *Annalen der Physik,* v. 17, no. 2-3, 1956, p. 94-101.

By smelting the components in a pressure bomb, compact, crystallized zinc arsenide can be obtained. It is a semiconductor with relatively high conductivity, suitable for contact rectifiers. Table, graphs, diagrams, diffractogram, photograph. 8 ref. (P15, As, Zn)

243-P. (German.) **Hall Effect of Pure Iron and a Steel with 1.2% C.** Werner Jellinghaus und Miguel Pedrode Andrés. *Archiv für das Eisenhüttenwesen,* v. 27, no. 3, Mar. 1956, p. 187-192.

Fundamentals of Hall effect in ferromagnetic materials. Auxiliary phenomena during measurements and comparison with data from literature. Effect of tempering. Tables, graphs, diagrams. 18 ref. (P15, Fe, Cn)

244-P. Thermal Conductivity of Zirconium and Zirconium-Tin Alloys. H. W. Deem. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* BMI-849, July 1953, 9 p.

Thermal conductivities of zirconium-tin alloys and a zirconium-uranium-tin-iron-chromium-nickel alloy measured over the temperature range 50 to 400° C. Thermal conductivity values at 300° C. ranged from 0.19 watt per cm. per °C. for unalloyed zirconium to 0.11 watt per cm. per °C. for the alloy with 7 wt.% tin. At lower temperature the spread is greater. Diagram, graph, table. (P11, Sn, Zr)

245-P. Porosity of Anodic Oxide Coatings on Aluminum. Comparison of *n*-Butane and Krypton Sorption. Lee A. Cosgrove. *Journal of Physical Chemistry,* v. 60, Apr. 1956, p. 385-388.

Surface area and pore volume and diameter of pores in coatings investigated by sorption techniques, using krypton at −195.8° C. and *n*-butane at 0° C. Table, graphs. 14 ref. (P10, L19, Al)

246-P. The Thermodynamic Properties of the Moderately Dilute Liquid Solutions of Copper, Silver and Gold in Thallium, Lead and Bismuth. O. J. Kleppa. *Journal of Physical Chemistry,* v. 60, Apr. 1956, p. 446-452.

Analytical method permits a derivation of important free energy, heat and entropy data from phase diagram information alone. Summary of all available thermodynamic data. Tables, graphs. 14 ref. (P12, M24, Tl, Bi, Pb, Au, Ag, Cu)

247-P. The Heat of Combustion of Calcium. Elmer J. Huber, Jr., and Charles E. Holley, Jr. *Journal of Physical Chemistry,* v. 60, Apr. 1956, p. 498-499.

Calorimetric combustions of calcium metal conducted at an initial temperature of 25° C. under oxygen pressure of 50 atmospheres. Table. 9 ref. (P12, Ca)

248-P. Dimensional Stability of Irradiated Thorium. J. B. Burnham and M. H. Bartz. *Phillips Petroleum (U. S. Atomic Energy Commission), Company, Atomic Energy Division* IDO-16162, Apr. 1954, 10 p.

Twenty Hanford-size thorium slugs were irradiated in two MTR reflector positions. Measurements show that hot rolled thorium is dimensionally stable under irradiation. Diagram, photograph, table. 12 ref. (P10, Th)

249-P. Thermoelectric Powers in Palladium-Silver and Palladium-Rhodium Alloys. J. C. Taylor and B. R. Coles. *Physical Review,* v. 102, ser. 2, Apr. 1, 1956, p. 27-30.

Thermo-electric powers measured in the temperature range 77 to 273° K. Graphs. 16 ref. (P15, Ag, Pd, Rh)

250-P. Modern Magnetic Materials. Malcolm McCaig. *Science Progress,* v. 44, Apr. 1956, p. 224-236.

Types of metallic and nonmetallic materials, their properties and applications. Diagrams, graphs. 7 ref. (P16, SG-n, p)

251-P. (French.) **The Adsorbing Capacity of Hard Materials and Its Relationship With Hardness and Reactivity.** G. F. Hüttig and E. Härtl. *Chimie & Industrie,* v. 75, no. 3, Mar. 1956, p. 503-508.

The adsorptive affinity of $MoSi_2$ and WSi_2 for gaseous ammonia. Theory of relationships between the energy of chemisorption, energy of formation of additive compounds, and energy of the crystalline lattice. Graphs, diagram, table. 9 ref. (P13, P12, Mo, Si, W)

252-P. (Russian.) **Surface Tension of Aluminum and Its Alloys.** A. M. Korol'kov. *Izvestiia Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk,* 1956, no. 2, Feb. 1956, p. 35-42.

Effect of the addition of various metals and of alloy proportions on surface tension and capillary radius. Role of melting method and fluxes employed. Tables, graphs. 29 ref. (P10, Al)

253-P. The Measurement of the Electrical Resistivity of Silicon. R. H. Creamer. *British Journal of Applied Physics,* v. 7, Apr. 1956, p. 149-150.

Modified four-probe method which employs probes made from wires containing a donor or acceptor-type impurity for *n*- or *p*-type silicon respectively. By discharging a condenser between the probes, low-resistance stable contacts are obtained which allow a steady current to flow in the specimen and permit the potential to be measured with a standard potentiometer. 3 ref. (P15, Si)

254-P. Cyclotron Irradiation Damage of Thorium, Stainless Steel, and Zirconium. F. E. Bowman, A. Andrew, R. R. Eggleston, F. L. Fillmore and C. J. Meechan. *North American Aviation, Inc. (U. S. Atomic Energy Commission),* NAA-SR-287, Apr. 1954, 30 p.

Effects of cyclotron irradation upon the hardness, the stress-strain relationship, and the electrical resistance of thorium, 347 stainless steel, and zirconium. Irradiations were carried out below −100° C. on the 60-in. Crocker cyclotron. Electrical resistance measurements were made at −146° C. and other measurements were made at room temperature. Graphs, micrographs, tables. 9 ref. (P10, P15, Q29, Th, SS, Zr)

255-P. Interpretation of Domain Patterns Recently Found in BiMn and SiFe Alloys. John B. Goodenough. *Physical Review,* v. 102, ser. 2, Apr. 15, 1956, p. 356-365.

In a demagnetized crystal in which closure domains do not form, the domain pattern on a surface perpendicular to the easy-magnetization axis varies with the thickness of the crystal. Theoretical predictions compared with domain patterns recently observed in BiMn alloys and in barium ferrite. Recently reported domain patterns in polycrystalline SiFe alloys interpreted as representing the latter thick-crystal configuration. Diagrams, graphs. 9 ref. (P16, Bi, Mn, Si, Fe)

256-P. Let's See How Aluminum Building Wire Compares With Copper. *Power,* v. 100, May 1956, p. 122-123.

Data on properties and current-carrying capacities. Diagrams, tables. (P15, Al, Cu)

257-P. Sulfides. John M. Blocher, Jr. Paper from "High-Temperature Technology". John Wiley & Sons. p. 187-207.

Lists sulfides with melting points above 1000° C., thermodynamic and physical properties, methods of preparation. Tables. 60 ref. (P12)

258-P. Melting-Point and Phase-Equilibrium Determinations. S. M. Lang. Paper from "High-Temperature Technology". John Wiley & Sons. p. 409-419.

The following methods are considered: phase identification, static test methods, and dynamic test methods; and general considerations. 44 ref. (P12, M24)

259-P. Thermal Conductivity. Roger J. Runck. Paper from "High-Temperature Technology". John Wiley & Sons. p. 429-446.
Fundamental principles and limits within which they may be employed; types of equipment and variations in design and use. Diagrams. 26 ref. (P11)

260-P. High-Temperature Measurement of Electrical Conductivity. Edward C. Henry. Paper from "High-Temperature Technology". John Wiley & Sons. p. 450-460.
Theory of electrical conduction in semiconductors and insulators; apparatus and methods; results of recent measurements on oxide and other mixtures. Diagrams, graphs. 35 ref. (P15)

261-P. (Dutch.) **Viscosity of Molten Metals.** *Metalen,* v. 11, no. 7, Apr. 15, 1956, p. 153-160.
Viscosity and its influence on the fluid molding of metals. Results with lead-bismuth alloys in a sphere-oscillation viscosimeter. Graphs, photograph, diagrams. 25 ref. (P10, Pb, Bi)

262-P. (German.) **Measurements of Soft Magnetic Materials by Means of Hall Generator.** Fritz Assmus and Richard Boll. *Elektrotecnische Zeitschrift,* v. 77, Ausgabe A, no. 8, Apr. 1956, p. 234-236.
Measurement of the tangential component of the field intensity in a range of 0.1 to 10 oersteds. Photograph, diagrams, graph. 12 ref. (P16, SG-p)

263-P. (German.) **Effect of Foreign Elements and Heat Treatment on the Electrical Properties of High-Purity Tellurium.** H. Kronmuller, J. Jaumaim and K. Seiler. *Zeitschrift für Naturforschung,* v. 11a, no. 3, Mar. 1956, p. 243-250.
Effect of addition of arsenic, antimony, bromine and iodine in micro quantities on the Hall effect and conductivity at −140 to 300° C. Tables, graphs. 5 ref. (P15, Te)

264-P. (Serbian.) **The Relation Between the Number of Particles in the Specific Volume, the Coefficient of Thermal Linear Expansion and the Heat of Fusion of Metals.** E. N. Dobrocvetov. *Glasnik Khemiskog Drushtva (Beograd),* v. 20, no. 3, 1955, p. 181-185.
Data and formulas for 25 metals. Tables. 10 ref. (P10, P11, P12)

265-P. (Book.) **Advances in Electronics and Electron Physics.** L. Marton, editor. v. VII. 527 p. 1955. Academic Press, 125 E. 23rd St., New York, N. Y. $11.50.
Physics of semiconductor materials, theory of the electrical properties of germanium and silicon, characteristic energy losses of electrons in solids, sputtering by ion bombardment, observational radio astronomy, analog computers, electrical discharge in gases and modern electronics. (P15)

Q

Mechanical Properties and Test Methods; Deformation

361-Q. Calibrated Porcelain Enamel Coatings. H. N. Staats and S. J. Baranowski. *American Ceramic Society Bulletin,* v. 35, Apr. 1956, p. 143-145.
New ceramic coatings which facilitate stress analysis of parts of operating equipment where heat and oil are present. Diagram, photographs. (Q25)

362-Q. Shock Simulator Shows Promise. E. J. Tangerman. *American Machinist,* v. 100, Apr. 23, 1956, p. 124-125.
New arrangement of piston and cylinder has real possibilities as a shock tester and as a press for high-velocity, high impact forming of aluminum, titanium and some steel alloys. Graphs, diagrams, photographs. (Q6, G general, Al, Ti, AY)

363-Q. Low-Nickel Austenitic Stainless Standardized. *American Machinist,* v. 100, Apr. 23, 1956, p. 126-128.
Types 201 and 202 can handle most jobs formerly done with 301 and 302. A summary of characteristics. Graphs, photographs. (Q general, SS)

364-Q. Biaxial Plastic Stress-Strain Relations of a Mild Steel for Variable Stress Ratios. Joseph Marin and L. W. Hu. *ASME Transactions,* v. 78, Apr. 1956, p. 499-508, disc. p. 508-509.
Plastic stress-strain relations for both constant and variable stress ratios and special tests for verifying certain requirements of plasticity theories. Graphs. 6 ref. (Q23, CN)

365-Q. The Stress-Rupture Strength of Type 347 Stainless Steel Under Cyclic Temperature. E. E. Baldwin. *ASME, Transactions,* v. 78, Apr. 1956, p. 517-525.
Stress-rupture tests were conducted in liquid sodium under constant and cyclic temperature conditions. Constant-temperature tests were conducted at temperatures between 1000 and 1200° F. Cyclic-test temperatures ranged from 416 to 1294° F., and cycle times ranged from 6 to 12 hr. Diagrams, graphs, micrographs, photographs, tables. 11 ref. (Q4, SS)

366-Q. Creep of 2S-O Aluminum Sheet at 400 to 450° C. W. F. Simmons and H. C. Cross. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* AECD-3926, June 1950, 11 p.
Data show that, at 400° C., 0.5% total deformation would be produced in 10,000 hr. by a stress of 250 psi. At 450° C., 200 psi. would be required. Graphs, table. (Q3, Al)

367-Q. The Mechanism of Plastic Deformation. W. T. Read, Jr. *Bell Laboratories Record,* v. 34, Apr. 1956, p. 133-137.
A discussion based on crystal models to determine why plastic deformation not only begins, but continues at unexpectedly low stresses, and why such deformation does not take place more or less homogeneously throughout the material, but is confined to slip planes. Diagrams, micrographs, photograph. 2 ref. (Q24)

368-Q. Elevated Temperature Properties of Beryllium. K. G. Wikle and W. W. Beaver. *Brush Beryllium Company (U. S. Atomic Energy Commission),* NYO-1114, July 1952, 22 p.
Tensile properties of hot-pressed beryllium in 250 to 950° C. range and of warm-pressed, hot-extruded beryllium in 250 to 600° C. range. Graphs, photographs, diagrams, tables. 3 ref. (Q23, Q27, Be)

369-Q. Notch Slow-Bend Testing of Zircaloy-2. R. G. Wheeler. *Hanford Atomic Products Operation (U. S. Atomic Energy Commission),* HW-40866, Jan. 1956, 20 p.
A recording tester that plots bending moment versus angle of bend rapidly detects small changes in mechanical properties using inexpensive equipment, minimum of material, and essentially no specimen machining. Photographs, micrograph, graphs. 20 ref. (Q5, Zr)

370-Q. Performance Tests on Indenters for Rockwell Hardness Testing. R. S. Marriner. *Industrial Diamond Review,* v. 16, Mar. 1956, p. 48-50.
Details of a method to eliminate local hardness variations of test blocks and variability of testing machines from results of different indenters. Diagrams, graph, tables. 2 ref. (To be continued.) (Q29, C)

371-Q. Relationship Between Small-Angle Dislocation Boundaries and Creep. Betsy Ancker, Thomas H. Hazlett and Earl R. Parker. *Journal of Applied Physics,* v. 27, Apr. 1956, p. 333-340.
Small-angle dislocation boundaries of controlled nature and density were introduced into high-purity polycrystalline nickel prior to creep at 700° C.; the shape of the creep curve was varied drastically. Graphs, micrographs, table. 16 ref. (Q3, Ni)

372-Q. Sensitivity of Ultrasonic Attenuation and Velocity Changes to Plastic Deformation and Recovery in Aluminum. Akira Hikata, Rohn Truell, Andrew Granato, Bruce Chick and Kurt Lücke. *Journal of Applied Physics,* v. 27, Apr. 1956, p. 396-404.
Measurements of changes in ultrasonic attenuation together with changes in ultrasonic velocity were made concurrently with load strain measurements in tensile tests on the same specimen. Graphs, tables. 14 ref. (Q24, N4, Al)

373-Q. Stress in Electrodeposited Coatings. Its Significance and Measurement. Joseph B. Kushner. *Metal Finishing,* v. 54, Apr. 1956, p. 48-51, 57.
Causes of cracking and other defects caused by stresses. Diagrams. (To be continued.) (Q25, L17)

374-Q. Current Studies of Large Forgings. A. O. Schaefer. *Metal Progress,* v. 69, Apr. 1956, p. 62-67.
Outline of studies to find the cause and cure of brittle fracture and establish inspection methods whereby potentially dangerous forgings can be identified. Graphs. (Q23, Q26, F22, S13, S22, AY)

375-Q. Mechanical Properties of Medium-Carbon Boron Steels. J. R. Kattus and C. L. Dotson. *Metal Progress,* v. 69, Apr. 1956, p. 68-72.
Tensile, fatigue, impact and notched tensile properties of tempered medium-carbon boron steels are equivalent to those of other low-alloy steels tempered to the same hardness levels. Graphs, table. (Q general, AY)

376-Q. High-Temperature Tests on Aluminum Sand Castings. *Metal Progress,* v. 69, Apr. 1956. p. 80-B.
Curves plot tensile and yield strength against test temperature for 11 commonly used aluminum casting alloys at various temperatures. Graphs, table. (Q23, Q27, Al)

377-Q. More Heat Treatable Titanium. H. E. Fuhrmeister, W. M. Parris and H. D. Kessler. *Steel,* v. 138, Apr. 23, 1956, p. 118-121.
Data on duplex solution and aging treatment and resulting properties of two alloys. Micrographs, graphs, tables. (Q23, J27, Ti)

378-Q. Investigation of the Ni_3Al Phase of Nickel-Aluminum Alloys. Edward M. Grala. *U. S. National Advisory Committee for Aeronautics, Technical Note* 3660, Apr. 1956, 24 p.
The effects of homogenization treatments and of composition on

the tensile properties of as-cast alloys in this phase region. Tables, graphs, photographs, micrographs. 4 ref. (Q27, Ni, Al)

379-Q. X-Ray Study of Behavior of Steels Under Repeated Cyclic Stress. A. Schaal. *Henry Brutcher Translation No.* 3102, 29 p. (Abridged from *Zeitschrift für Metallkunde,* v. 40, no. 11, 1949, p. 417-427.) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 94-Q, 1950. (Q25)

380-Q. Strength and Ductility of Metals at Low and Extremely Low Temperatures. G. V. Uzhik. *Henry Brutcher Translation No.* 3537, 13 p. (Abridged from *Izvestiya Akademii Nauk SSSR, OTN,* no. 1, 1955, p. 57-66) Henry Brutcher, Altadena, Calif.

Previously abstracted from original. See item 608-Q, 1955. (Q23, Q24, AY, CN, SS, Cl, Cu, Al, Cd)

381-Q. On the Connection Between Static and Kinetic Friction. N. F. Kunin and G. D. Lomakin. *Henry Brutcher Translation No.* 3650, 7 p. (From *Zhurnal Tekh. Fiziki,* v. 24, no. 8, 1954, p. 1367-1370.) Henry Brutcher, Altadena, Calif.

Study of changes in frictional force with metals, as an example of ordered microrupture, strain-hardening, and relaxation effects. Graphs. 3 ref. (Q9)

382-Q. Role of Inhomogeneity in Plastic Deformation. C. Zener. Paper from "High Temperature Properties of Materials". Department of Engineering Mechanics, Pennsylvania State University. p. 1-8.

Diagrams illustrate homogeneous and inhomogeneous deformation under various conditions. 7 ref. (Q24, Q27)

383-Q. Mechanical Properties of Metals at High Temperatures, Non-Periodic Loading. M. J. Manjoine. Paper from "High Temperature Properties of Materials". Department of Engineering Mechanics, Pennsylvania State University, p. 9-20.

Factors affecting elasticity, plasticity and failure of metals during their service life. Graphs. 22 ref. (Q general)

384-Q. Mechanical Dynamic Properties at High Temperatures. B. J. Lazan. Paper from "High Temperature Properties of Materials". Department of Engineering Mechanics, Pennsylvania State University. p. 21-60.

Reviews properties under the action of simple external forces which normally result in a simple stress system, and factors governing the flow and failure of metals during their service life. Graphs, diagrams, table. 29 ref. (Q general, S21, ST)

385-Q. Metallurgical Effects in High-Temperature Properties of Metals. G. V. Smith. Paper from "High Temperature Properties of Materials". Department of Engineering Mechanics, Pennsylvania State University. p. 61-77.

Many properties of interest in applying metals at elevated temperatures are affected by metallurgical variables such as chemical composition, melting and deoxidation practices, and heat treatment. Graphs, micrographs. 35 ref. (Q3, ST)

386-Q. Design for High Temperatures. D. R. Miller. Paper from "High Temperature Properties of Materials". Department of Engineering Mechanics, Pennsylvania State University. p. 79-92.

Review of problems facing the designer of apparatus for high-temperature service. Graphs. 16 ref. (Q general, ST)

387-Q. (German.) **Recent Results From Investigation of the "True Elastic Limit".** E. Mohr. *Aluminium,* v. 32, no. 4, Apr. 1956, p. 202-204.

Extensive comparative studies show that the bending tensile strength obtained from tests involving combination of static with cyclic stressing must be close to the fatigue strength. Diagram, photograph, graphs, tables. (Q21, Al)

388-Q. (German.) **The Directionality of Hardness of Aluminium.** P. Grodzinski. *Aluminium,* v. 32, no. 4, Apr. 1956, p. 208-209.

Experiments with a specially shaped double cone-diamond, with which the directionality of the hardness as a function of the crystal orientation can be clearly demonstrated. Graphs, table, micrograph, diagrams. 6 ref. (Q29, Al)

389-Q. (German.) **Investigation of Rolled and Recrystallized Textures of Carbonyl Steel.** Frank Haessner and Helmut Weik. *Archiv für das Eisenhüttenwesen,* v. 27, no. 3, Mar. 1956, p. 153-160.

Determination on straight and cross rolled sheets by means of X-rays. Influence of annealing and working on the formation of recrystallization textures. Tables, diagrams, diffractograms. 24 ref. (Q24, N5, CN)

390-Q. (Russian.) **Plastic Deformation and Fracture of Metallic Single and Polycrystals, With Static and Repeated Torsion.** F. P. Rybalko. *Fizika metallov i metallovedenie,* v. 1, no. 2, 1955, p. 231-238 + 2 plates.

Tests reveal that fracture is preceded by localization of the deformation in zones of certain orientations. Relation between rate of deformation and dislocation at different stages. Graph, photographs, micrographs. 6 ref. (Q24, Q26, Cu, Zn, Cd, Al)

391-Q. (Russian.) **Problem of the Effect of Friction on the Changes in the Stressed State of Surface Layers of Metals During Plastic Compression.** K. V. Savitskii. *Fizika Metallov i Metallovedenie,* v. 1, no. 2, 1955, p. 239-245.

Data on effects of lubrication on numerical values of stresses during the plastic compression of copper. Relation between contact stresses and differences in the geometrical shape of the test pieces. Possibility of determining effectiveness of lubricants, under plastic compression conditions, by the magnitude of difference in contact and mean true stresses. Graphs, table, photograph. 4 ref. (Q24, Q9, Cu)

392-Q. (Russian.) **Problem of Deformability of Alloys in a Metastable State.** M. B. Makogon. *Fizika metallov i metallovedenie,* v. 1, no. 2, 1955, p. 246-250.

Effect of rate of plastic deformation on resistance to deformation by duralumin in quench-hardened, annealed, and aged states, at temperatures of +20 and −50° C. Relaxation and aging with respect to the effect of plastic deformation. Conditions of plastic deformation, of alloys in the metastable state, affect properties of the metal after aging. Graphs. 15 ref. (Q24, Al)

393-Q. (Russian.) **Study of Microscopic Nonunifomity of the Plastic Deformation of Steel.** B. B. Chechulin. *Fizika metallov i metallovedenie,* v. 1, no. 2, 1955, p. 251-260.

Character of plastic deformation of metals as contrasted with deformation of usual isotropic bodies. Distribution of deformations of real polycrystalline metals; position of grain axes during plastic flow or creep. Diagram, graphs, table. 3 ref. (Q24, Q3, AY, CN, Al)

394-Q. (Russian.) **Some Regularities of Plastic Deformation and Fracture of Metals Under Tension.** V. A. Pavlov and K. A. Vshivtseva. *Fizika metallov i metallovedenie,* v. 1, no. 2, 1955, p. 261-268.

Experimental data on temperature relation of complete and uniform elongations, and on variation in the character of fracture during tensile stressing of metals. Graphs, table, photograph. 10 ref. (Q24, Q26, Q27, Cd, Pb, Mg, Fe)

395-Q. (Russian.) **Study of Diffusion Creep of Metals and Alloys. I. Diffusion Creep of Fine Metal Threads.** Ia. E. Geguzin and V. Z. Bengus. *Fizika Metallov i Metallovedenie,* v. 1, no, 2, 1955, p. 269-272.

Relation of relative elongation to time. Diffusion dislocation and transfer of atoms. Distinction between diffusion creep and plastic deformation, occurring during slip and twinning processes. Photograph, diagram, graphs. 8 ref. (Q3, Q24, Pb)

396-Q. (Russian.) **Distribution of Internal Stresses in Plates Butt-Welded in One Operation.** V. S. Ignat'eva. *Svarochnoe Proizvodstvo,* 1956, no. 3, Mar. 1956, p. 12-17.

Attempts to determine the third component of tri-axial residual stress in plates. Inverse relation of the third component to the thermal load; slow increase in this component with the thickness of the plate. Longitudinal and transverse stresses as functions of the width and the thickness of the plate. Calculation of plastic deformations in welded joints. Diagrams, graphs. 12 ref. (Q24, Q25)

397-Q. Hot-Hardness Survey of the Zirconium-Uranium System. W. Chubb, G. T. Muehlenkamp and A. D. Schwope. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* BMI-833, May 1953, 16 p.

Survey made at temperatures from room temperature to 900° C. Composition of maximum hardness increases from 40 at. % zirconium at room temperature to 60 at. % zirconium at 600° C. At 700° C., the hardness data indicated the presence of the beta uranium phase in alloys containing 95 and 100 at. % uranium. Diagram, graphs, tables. (Q29, M24, Zr, U)

398-Q. Mechanical Properties of Striated Uranium Slugs. M. L. Holzworth. *E. I. du Pont de Nemours & Co., Savannah River Laboratory, Technical Division (U. S. Atomic Energy Commission),* DP-139, Nov. 1955, 27 p.

Nonmetallic inclusions, which are described as "striations" have no adverse effect on the tensile, impact, torsion or fatigue strength of uranium slugs. Mechanical properties are primarily dependent on crystallographic orientation which may be varied by heat treatment. Diagrams, graphs, photographs, tables. 8 ref. (Q general, U)

399-Q. The Straining of Metals by Indentation Including Work-Softening Effects. G. H. Williams and Hugh O'Neill. *Iron and Steel Institute, Journal,* v. 182, Mar. 1956, p. 266-273.

The process of elastic and plastic indentation is reviewed, and strain-hardening examined by explorations upon and below indentations in steel, aluminum and copper. Main study was on annealed copper using conical tools of three different angles, and indentations of increasing depths made with a ball. Graphs, tables. 24 ref. (Q29, N7, Al, Cu, ST)

400-Q. A Study of the Impact Properties of Boron-Treated Steel. Samuel J. Rosenberg and John D. Grims-

ley. *Iron and Steel Institute, Journal,* v. 182, Mar. 1956, p. 278-292.

Twenty-one steels from the same openhearth heat and made to a base composition of 0.43% carbon and 1.60% manganese, were studied to evaluate the effect of boron on the Charpy V-notch impact properties over the temperature range of −140 to +140° F. Diagram, graphs, tables. 9 ref. (Q6, ST)

401-Q. Application of Electrical Analogy for the Solution of Problems in Elasticity. V. Cadambe and S. G. Tewari. *Journal of Scientific & Industrial Research,* v. 15, sec. B, Mar. 1956, p. 107-111.

Design of an electrolytic tank and accessories; technique of measuring the potential distribution for solving Laplace equation; problem of bending a prismatic triangular bar. Shear stresses calculated along the section of symmetry. Diagram, graphs. 4 ref. (Q21)

402-Q. Creep of High-Purity Nickel. *Metal Industry,* v. 88, Apr. 6, 1956, p. 265-266.

Creep behavior in tension of annealed specimens under constant load at 300, 700, 900 and 1200° F. Graphs, photographs. (Q3, Ni)

403-Q. Avoiding Weld Failures in Austenitic Stainless Steel Pipe. *Metal-Working,* v. 12, May 1956, p. 14-17.

Common causes of failure and how to avoid them. Tables. (Q26, K1, SS)

404-Q. Analysing Stress by Rubber Models. L. Chitty. *Rubber Developments,* v. 9, Spring, 1956, p. 5-7.

Recent advances in technique of molding rubber have opened up a new field in obtaining solutions to design of structures. Photographs. (Q23, ST)

405-Q. "Miles Per Quart +". IV. Wear; Engine Sludge; Oil Consumption. J. M. Nuttall. *Scientific Lubrication,* v. 8, Apr. 1956, p. 19-23.

Study of wear in engines, using lubricants with and without corrosion-inhibiting additives. Photographs. (To be continued.) (Q9, R10)

406-Q. Fracture Behavior in the Notch Slow-Bend Test. W. J. Murphy and R. D. Stout. *Welding Journal,* v. 35, Apr. 1956, p. 169S-180S.

Effect of weld metal, heat affected zone and unaffected base plate in the initiation and propagation of the crack leading to brittle failure. Diagrams, tables, graphs, micrographs. 8 ref. (Q26, Q5, ST)

407-Q. Effect of Cold Work on the Mechanical Properties of Pressure Vessel Steels. W. T. Lankford. *Welding Journal,* v. 35, Apr. 1956, p. 195S-206S.

Appraises present knowledge regarding effects of cold work on mechanical properties of steels; indicates areas where further research is needed. Graphs, tables. 37 ref. (Q general, G general, ST)

408-Q. (French.) **Fatigue of Duralumin Sheet With Surface Pits.** Enrique J. G. Sardinero. *Technique et Science Aéronautiques,* 1955, no. 6, p. 367-372.

Tests conducted to determine effects of localized corrosion on the fatigue strength of duralumin sheets. Micrographs, photographs, graph. 10 ref. (Q7, R2, Al)

409-Q. (German.) **Revision of Mechanical and Technological Properties of Type "G" $AlSi_6Cu_3$ Alloy With Greater Changes in Concentration of the Alloying Elements.** E. Bertram, R. Kümmerle and O. Asbeck. *Giesserei,* v. 43, no. 7, Mar. 29, 1956, p. 153-159.

Investigation of heat cracking, mechanical properties of ingot-mold specimens, effect of grain refinement. Tables, diagrams, photographs, graphs, micrographs. 5 ref. (Q general, E25, Al)

410-Q. (German.) **Comparative Ductility Investigation of Case Hardened Steels.** M. Kroneis. *Schweizer Archiv für Angewandte Wissenschaft und Technik,* v. 22, no. 3, Mar. 1956, p. 85-92.

Impact ductility of alloyed and unalloyed case hardened steels; Cr-Ni, Cr-Mo, Ni-Mo, and Ni-steels as well as Cr-Mn and Cr-steels were investigated. Graphs, diagrams, tables. (Q6, Q23, ST)

411-Q. (Japanese.) **On the Brittle Fracture of Welded Structures.** Midori Otani. *Journal of Railway Engineering Research, (Japan),* v. 13, nos. 2-3, Feb. 10, 1956, p. 36-80.

Brittle fractures were assorted into four classes and the phenomena investigated, using specimens suitable for surveying each type. Diagrams, graphs, tables, photographs. 56 ref. (Q26)

412-Q. (Japanese.) **Notch Sensitivity of Steels.** Midori Otani. *Journal of Railway Engineering Research, (Japan),* v. 13, nos. 2-3, Feb. 10, 1956, p. 81-89.

Reports on the notch sensitivity of steels and the brittle fracture of welded structures reviewed, further research problems surveyed. Diagrams, photographs, graph. 46 ref. (Q23, ST)

413-Q. (Polish.) **Silicon Steel of Increased Strength Properties.** I. S. Przegalinski. *Prace Instytutow Ministerstwa Hutnictwa,* v. 8, no. 1, 1956, p. 17-26.

Investigates possibility of substituting silicon for manganese in steel of the type ST52. Graphs, tables. 63 ref. (Q23, AY)

414-Q. (Russian.) **Resistance of Metals and Minerals, Including Very Hard Ones, to Abrasive Wear.** M. M. Khrushchov and M. A. Babichev. *Doklady Akademii Nauk SSSR,* v. 107, no. 1, Mar.-Apr. 1956, p. 75-78.

Tests provide data to plot relation between hardness and wear resistance. Nature of this relationship. Graphs, tables. 5 ref. (Q29, Q9, Co, Cr, Ti, Mo, Be)

415-Q. (Russian.) **Electrocapillary Effect in Reducing Hardness and External Friction of Metals.** E. K. Vengstrem, V. I. Likhtman and P. A. Rebinder. *Doklady Akademii Nauk SSSR,* v. 107, no. 1, Mar.-Apr. 1956, p. 105-107.

Potentials of null charge of hard metals. Role of adsorptive layers and adsorption of surface-active substances on frictional properties. Table, graph. 18 ref. (Q29, Q9, Zn, Pb, Au, Te, Pt)

416-Q. (Russian.) **Work-Hardening Curves of Technical Iron.** S. I. Gubkin and G. N. Mekhed. *Izvestiia Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk,* 1956, no. 2, Feb. 1956, p. 132-135.

Curves under two types of load (mono-axial tension and torsion), and various formulas (Osipov's, Nadai's) for them. Octahedral tangential stress and octahedral sheer formulas. Graphs, photographs. 4 ref. (Q23, Fe)

417-Q. (Russian.) **Distribution of Contact Stresses Between Shrink-Fitted Sleeve and Shaft.** M. M. Kobrin. *Izvestiia Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk,* 1956, no. 2, Feb. 1956, p. 136-139.

Strength of unions where sleeve has been fitted on when hot or forced on. Experimental data compared with data according to Lamé's formula for determining contact stresses. Conditions under which even stress distribution is achieved. Graphs, diagrams. 4 ref. (Q25, K13)

418-Q. (Russian.) **A New Material "Gliftamal" for Plane Models Used in the Polarization-Optical Method of the Study of Stresses.** M. F. Bokshtein, N. I. Prigorovskii, S. I. Sokolov and N. A. Shchegolevskaia. *Izvestiia Akademii Nauk SSSR, Otdelenie Khimicheskikh Nauk,* 1956, no. 2, Feb. 1956, p. 139-141.

Various types of "Gliftamal" have been developed. Use in creep and other tests of machine parts and constructions. Photograph, table, diagram. 7 ref. (Q3, Q25)

419-Q. (Russian.) **Effect of Zirconium on Some Properties of Magnesium Alloys.** F. A. Borin and E. S. Sollertinskaia. *Metallovedenie i Obrabotka Metallov,* 1956, no. 2, Feb. 1956, p. 8-13.

Effect of zirconium, zinc and zirconium together, grain size, and heat and corrosion resistance on mechanical properties, especially long-term hardness, of cast, stamped and aged specimens of magnesium alloys. Graphs, micrographs, tables. 5 ref. (Q general, R general, M27, Mg, Zn, Zr)

420-Q. (Russian.) **Effect of Arsenic on the Fatigue Strength of Rails.** L. M. Shkol'nik. *Metallovedenie i Obrabotka Metallov,* 1956, no. 2, Feb. 1956, p. 14-21.

Chemical composition, mechanical properties and service life (number of cycles before fracture) of rails in fatigue tests. Coefficients of correlation characterizing the effect of arsenic, carbon, manganese and phosphorus on service life (before fracture) of rails. Graphs, tables, photographs, diagram. 4 ref. (Q7, S21, CN)

421-Q. (Russian.) **Thermal and Temper Brittleness of Ferritic (Pearlitic) Steel.** P. B. Mikhailov-Mikheev. *Metallovedenie i Obrabotka Metallov,* 1956, no. 2, Feb. 1956, p. 23-33.

Sensitivity of various pearlitic steels to thermal brittleness during lengthy soakings, with and without load. Effect of repeated tempering on impact strength of previously quenched and tempered steels. Effect of tempering temperature, cooling rate, alloy composition and heat treatment combinations. Physical nature of brittleness, including segregation at grain boundaries and lattice dislocations. Graphs, table. 18 ref. (Q23, J29, ST, SS)

422-Q. (Russian.) **Nature of Temper Brittleness of Pearlitic Steels.** V. I. Prosvirin and E. I. Kvashnina. *Metallovedenie i Obrabotka Metallov,* 1956, no. 2, Feb. 1956, p. 34-49.

Chemical compositions of steels used; change in quantity of carbides in steels passing into brittle state; microstructure of brittle and nonbrittle specimens; effect of heat treatment conditions, including tempering time and high-temperature tempering on secondary phases and internal friction; role of molybdenum in checking tempering brittleness; effect of quenching temperature on grain size and impact strength. Graphs, tables, micrographs. 36 ref. (Q23, Q22, J29, AY)

423-Q. (Russian.) **Effect of Titanium on Properties of X15H60 and X20H80 Alloys.** *Stal',* v. 16, no. 3, Mar. 1956, p. 217-220.

The presence of titanium in nick-

el-chromium steels improves fabrication characteristics and mechanical properties, increases their electrical resistance. Tables, graphs. 3 ref. (Q general, P15, AY)

424-Q. (Russian.) **Internal Stress in Electrodeposits. I. Stresses in Deposits of Zinc.** K. M. Gorbunova and O. S. Popova. *Zhurnal Fizicheskoi Khimii,* v. 30, no. 2, Feb. 1956, p. 269-276.

Internal stresses of the deposits and their nature in connection with the surface and crystalline structure. Effect of electrolyte composition, current density and deposit thickness on the stress. Diagram, graphs, electromicrographs. 10 ref. (Q25, L17)

425-Q. (Spanish.) **Variation in the Properties of Spring Steels as a Function of Their Heat Treatment and Surface Finish.** Mario Pujol Roig. *Instituto del Hierro y del Acero,* v. 9, no. 43, Feb. 1956, p. 183-197; disc., p. 197-198.

Types of steel for springs, with the appropriate heat treatments. Experimental study of a carbon spring steel—physical properties, tests, heat treatment (classical and isothermal), surface treatments. Relation of type of heat and surface treatments to fatigue behavior. Treatment resulting in bainitic structure. Advantages of polishing and phosphatizing. Tables, diagrams, photographs, micrographs, graphs. 11 ref.
(Q7, J general, L14, CN, SG-b)

426-Q. (Spanish.) **Contribution to the Study of Microhardness.** Francisco Munoz del Corral. *Instituto del Hierro y del Acero,* v. 9, no. 43, Feb. 1956, p. 199-212.

Revision of the concepts of Brinell and Vickers hardness. Critique of theory of microhardness variation as explained by load. Importance of difference between hardness of surface layers and inner metal. Effect of electropolishing in hardness testing. Tables, graphs. 10 ref. (Q29, L13, AY, Cu)

427-Q. (Swedish.) **The Charpy V-Notch Test Piece for Testing Mild Steel for Welding Purposes.** G. Malmberg. *Jernkontorets Annaler,* v. 140, no. 2, 1956, p. 87-100.

Impact strength vs. temperature curves determined for a series of mild steels. Tables, graphs. (Q6, K9, CN)

428-Q. **A Small and Inexpensive Device for Sustained Loading Testing.** R. H. Raring and J. A. Rinebolt. *ASTM Bulletin,* 1956, no. 213, Apr. 1956, p. 74-76.

An easily made tensile loading device provides a cheap, fast and satisfactory testing method. Photographs. 5 ref. (Q27)

429-Q. **Hot Tearing of Castings: A Review of the Literature.** R. A. Dodd. *Canada, Department of Mines and Technical Surveys, Mines Branch Research Report No.* PM184, July 1955, 47 p.

Occurrence, classification and identification of hot tears; theories of hot tearing; effect of composition; methods of assessing susceptibility to hot tearing. Diagrams, graphs, micrograph, photographs. 67 ref. (Q23)

430-Q. **Hot Tearing of Binary Magnesium-Aluminium and Magnesium-Zinc Alloys.** R. A. Dodd. *Canada, Department of Mines and Technical Surveys, Mines Branch Research Report No.* PM191, Aug. 1955, 21 p.

The susceptibility to hot tearing of alloys containing up to 10% alloying additions determined by method involving measuring the cracking tendency of flat rings cast in a steel mold. Diagrams, graphs, photographs. 10 ref.
(Q23, Al, Zn, Mg)

431-Q. **Textures in Rolled Uranium Rod.** W. P. Chernock and L. W. Kates. *Sylvania Electric Products, Inc. (U. S. Atomic Energy Commission),* AECD-3999, Apr. 1952, 21 p.

The textures in a hot-pressed uranium rod invetigated after reductions of area were made up to 70%. The texture at 70% reduction of area could best be described as very close to an (O41) fiber texture. Tables, graphs, diagrams. 4 ref. (Q24, U)

432-Q. **Effect of Varying Reduction on the Preferred Orientation in Rolled Uranium Rods.** M. H. Mueller, H. W. Knott and P. A. Beck. University of Chicago, Argonne National Laboratory (U. S. Atomic Energy Commission), AECD-4208, May 1954, 32 p.

Study of preferred orientation in uranium rod investigated after reductions at 300 and 600° C. The type of orientation developed by 600° C. rolling is somewhat different from that obtained by 300° C. rolling. Thermal cycling and thermal expansion data for these rods. Diagrams, graphs, tables. 9 ref. (Q24, U)

433-Q. **Introductory Paper.** N. P. Allen. Paper from "Creep and Fracture of Metals at High Temperatures". Her Majesty's Stationery Office. p. 1-17 disc. 18.

Progress made in the study of plastic deformation and fracture since 1946. Graphs, micrographs, tables. 9 ref. (Q3, Q26)

434-Q. **A Discussion of Some Models of the Rate-Determining Process in Creep.** N. F. Mott. Paper from "Creep and Fracture of Metals at High Temperatures". Her Majesty's Stationery Office. p. 21-24.

Conclusion is that there are great difficulties in accepting the hypothesis of "climb" of dislocations, and that cell formation (polygonization) may occur through slip alone. In this case the rate-determining process must be slip, and it is suggested that the barriers of greatest importance are jogs in screw dislocations. Diagram. 14 ref.
(Q3, Q24, M26, N5)

435-Q. **Plastic Deformation of Aluminium Single Crystals at Elevated Temperatures.** R. D. Johnson, A. P. Young and A. D. Schwope. Paper from "Creep and Fracture of Metals at High Temperatures". Her Majesty's Stationery Office. p. 25-45; dis. 46.

Creep tests were performed at elevated temperatures while maintaining a constant resolved shear stress to study the nature of the creep curve in crystals oriented for single slip on a (111) plane. Diagrams, graphs, micrographs, table. 43 ref. (Q3, Q24, Al)

436-Q. **Mechanism of Grain Boundary Displacement and Its Relation to the Creep Process as a Whole.** F. N. Rhines. Paper from "Creep and Fracture of Metals at High Temperatures". Her Majesty's Stationery Office. p. 47-56; disc. 57.

Tensile creep behavior of pure aluminum bicrystals, having flat grain boundaries at 45° to their axes of loading. Graphs, micrographs, photograph. 8 ref. (Q3, N3, Al)

437-Q. **Interaction Between Crystal Slip and Grain Boundary Sliding During Creep.** D. McLean. Paper from "Creep and Fracture of Metals at High Temperatures". Her Majesty's Stationery Office. p. 73-87; disc. 88.

Rotation of sub-crystals in aluminum during creep is shown to be proportional to elongation, from which it is deduced that practically all the crystal deformation occurs by a normal glide process; the amount of grain boundary sliding occurring in aluminum and copper during creep is shown to be proportional to elongation, suggesting that a linear interaction exists between crystal slip and grain boundary sliding. Diagrams, graph, micrographs, table. 22 ref.
(Q3, Q24, Al, Cu)

438-Q. **Some Fundamental Experiments on High Temperature Creep.** John E. Dorn. Paper from "Creep and Fracture of Metals at High Temperatures". Her Majesty's Stationery Office. p. 89-132; disc. 133-134.

Analysis of previously published and unpublished experimental observations. Graphs, tables, photograms, micrographs. 55 ref. (Q3)

439-Q. **Creep and Aging Effects in Solid Solutions.** A. H. Cottrell. Paper from "Creep and Fracture of Metals at High Temperatures". Her Majesty's Stationery Office. p. 141-152; disc. 153-155.

If recovery occurs during creep the creep resistance is reduced; if strain aging occurs, it is increased. Aging in substitutional alloys is accelerated during plastic flow. Other aspects considered. Graphs, micrographs, table. 35 ref. (Q3, N7)

440-Q. **Microstructure and Creep.** J. W. Freeman and C. L. Corey. Paper from "Creep and Fracture of Metals at High Temperatures". Her Majesty's Stationery Office. p. 157-172; disc. 173.

Relationships between microstructure and creep reviewed from standpoint of extensive research on engineering alloys. Principles involved in solid solution, precipitation phenomena, cold work, multiphases, transformation structures, melting practice and grain size. Graphs, tables. 31 ref. (Q3, N7, N12)

441-Q. **The Effect of Alloying on the Creep of Metals.** L. Rotherham and C. R. Tottle. Paper from "Creep and Fracture of Metals at High Temperatures". Her Majesty's Stationery Office. p. 175-188; disc. 189.

Theories of creep, effects of solid solution alloys and complex alloys. Graphs. 66 ref. (Q3)

442-Q. **Basic Principles of a Creep-Resisting Alloy.** A. Constant and G. Delbart. Paper from "Creep and Fracture of Metals at High Temperatures". Her Majesty's Stationery Office. P. 191-210; disc. 211-214.

Fabrication and shaping, properties of importance during use, resistance to creep, influence of heat treatment. Graphs, micrographs, tables. 27 ref. (Q3, SG-h)

443-Q. **Creep of Solid Solutions and Compounds in Metallic Systems.** I. I. Kornilov. Paper from "Creep and Fracture of Metals at High Temperatures". Her Majesty's Stationery Office. p. 215-219.

Short survey of creep tests on solid solutions and compounds in metallic systems and general conclusions drawn as a result of this work. Graphs. 21 ref. (Q3)

444-Q. **The Effect of Changing Loads During Creep.** Y. N. Rabotnov. Paper from "Creep and Fracture of Metals at High Temperatures". Her Majesty's Stationery Office. p. 221-224, disc. 225.

Certain possibilities of the phenomenological description of one-dimensional creep in tension. Graphs. 5 ref. (Q3)

445-Q. Theory of Accelerated Creep and Rupture. C. Crussard and J. Friedel. Paper from "Creep and Fracture of Metals at High Temperatures". Her Majesty's Stationery Office. p. 243-262.

An attempt to classify and clarify the most important facts which have been established in this field by various authors. Diagrams, graphs. 50 ref. (Q3, Q4)

446-Q. A Theory of Brittle and Ductile Fracture With Application to Creep Fracture, Based on the Dynamic Behaviour of Dislocations and Condensation of Vacancies. A. Kochendörfer. Paper from "Creep and Fracture of Metals at High Temperatures". Her Majesty's Stationery Office. p. 263-280.

Two processes presented, one based on dynamic behavior of dislocations leading to brittle fracture, the other on the condensation of vacancies produced by dislocations leading to ductile fracture. Diagrams, graphs, tables. 66 ref. (Q26, Q3, M26)

447-Q. Observations on Third Stage Creep and Fracture. C. H. M. Jenkins. Paper from "Creep and Fracture of Metals at High Temperature". Her Majesty's Stationery Office. p. 287-298; disc., p. 308-316.

Occurrence and mutual relationship of intercrystalline cracking, polygonization, recrystallization and transcrystalline rupture in metals and alloys at elevated temperatures. Tests were made in creep units thermostatically controlled and maintained for long periods in high vacuum. Micrographs, table. 7 ref. (Q3, Q26, N5)

448-Q. Tertiary Creep of Nimonic 80A. W. Betteridge. Paper from "Creep and Fracture of Metals at High Temperatures". Her Majesty's Stationery Office. p. 299-307; disc., p. 308-316.

Experiments were planned to measure the changes occurring during the course of a normal tensile creep test, particular attention being given to the stage of tertiary creep. Results lead to a formula for the creep curve which agrees very accurately with the observed curves for this alloy. Graphs, micrographs, tables. 5 ref. (Q3, Ni)

449-Q. Grain Boundary Participation in Creep Deformation and Fracture. N. J. Grant. Paper from "Creep and Fracture of Metals at High Temperatures". Her Majesty's Stationery Office. p. 317-330; disc., p. 331.

Based on creep-rupture studies of a series of metals and alloys varying in composition from that of very high-purity aluminum to that of a complex age-hardenable gas turbine alloy, it is shown how alloying affects the behavior of grain boundary deformation and fracture. Graphs, micrographs. 6 ref. (Q3, Q26, M27, Al, SG-h)

450-Q. Investigations Into the Development of Intercrystalline Fractures in Various Steels Under Triaxial Stress. W. Siegfried. Paper from "Creep and Fracture of Metals at High Temperatures". Her Majesty's Stationery Office. p. 333-360; disc., p. 261.

Tests carried out to obtain data for the practical application of the metals while at the same time revealing the physical facts reflected in these processes. Diagrams, graphs, tables. 15 ref. (Q26, ST)

451-Q. Note on the Fracture Under Complex Stress Creep Conditions of an 0.5% Molybdenum Steel at 550° C., and a Commercially Pure Copper at 250° C. A. E. Johnson and N. E. Frost. Paper from "Creep and Fracture of Metals at High Temperatures". Her Majesty's Stationery Office. p. 363-378; disc., p. 379-382.

Includes graphs, tables. 3 ref. (Q3, Q4, Q26, Cu, AY)

452-Q. The Effect of a "V" Notch on the Tensile Creep Behaviour of a Molybdenum-Vanadium Steel. R. W. Ridley and H. J. Tapsell. Paper from "Creep and Fracture of Metals at High Temperatures". Her Majesty's Stationery Office. p. 383-400; disc., p. 401-402.

Tensile creep tests were made on a molybdenum-vanadium steel over the range 650-525° C. and at stresses of from 17 to 5 tons per sq. in. using test pieces in which the "V" notch was machined circumferentially. Diagrams, graphs, micrographs, tables. 9 ref. (Q3, AY)

453-Q. Torsion-Testing Equipment for High-Temperature Creep Studies. J. A. Stavrolakis. Paper from "High-Temperature Technology". John Wiley & Sons. p. 397-402.

Report of equipment which permits measurements of strain within a uniform temperature interval; schematic representation and operation of the system. Diagrams, photographs. (Q3, Q1)

454-Q. Influence of Boron on Cast Cobalt-Base S-816 Alloy. W. E. Blatz, E. E. Reynolds and W. W. Dyrkacz. Paper from "Symposium on Metallic Materials for Service at Temperatures Above 1600° F." American Society for Testing Materials, p. 16-23; disc., p. 24-28.

Cast cobalt-base alloys with stress-rupture properties at 1650° F. equivalent to those of S-816 alloy at 1500° F. were developed. Optimum rupture strengths plus good rupture ductility are obtained with approximately 1% boron. Mircrographs, tables, graphs. 2 ref. (Q4, Co)

455-Q. Effect of Heat Treatment and Structure Upon Creep Properties of Nimonic Alloys Between 750 and 950° C. W. Betteridge and R. A. Smith. Paper from "Symposium on Metallic Materials for Service at Temperatures Above 1600° F." American Society for Testing Materials, p. 29-39.

Four heat treatment methods and resulting creep properties. Influence of titanium and aluminum content, effect of precipitation. Tables, graphs, micrographs. 9 ref. (Q3, J general, N7, Ni)

456-Q. Effect of Rare Earth Additions on the High-Temperature Properties of a Cobalt-Base Alloy. J. E. Breen and J. R. Lane. Paper from "Symposium on Metallic Materials for Service at Temperatures Above 1600° F." American Society for Testing Materials. p. 57-65; disc., p. 66-68.

High-temperature strength, as well as ductility, were increased in both as-cast and aged material at all temperatures investigated, with the greatest benefit occurring at 1500° F. Photograph, tables, graphs. 10 ref. (Q general, Co)

457-Q. Stress-Rupture Properties of Inconel 700 and Correlation on the Basis of Several Time-Temperature Parameters. S. S. Manson and G. Succop. Paper from "Symposium on Metallic Materials for Service at Temperatures Above 1600° F." American Society for Testing Materials, p. 40-46.

Alloy shows promise for use at a temperature of 1600° F. and perhaps higher. Table, graphs. 10 ref. (Q4, Ni)

458-Q. Creep, Rupture, and Notch Sensitivity Properties of S-816 Alloy Up to 1650° F. Under Fatigue and Static Stress. F. Vitovec and B. J. Lazan. Paper from "Symposium on Metallic Materials for Service at Temperatures Above 1600° F." American Society for Testing Materials. p. 69-88; disc., p. 89.

Role of creep and fatigue as design factors. Relation of notch sensitivity to loading conditions with particular reference to temperature and ratio of alternating-to-mean stress. Micrographs, graphs. 11 ref. (Q2, Q7, Co)

459-Q. High-Temperature Properties of Molybdenum-Rich Alloy Compositions Made by Powder Metallurgy Methods. W. L. Bruckart and R. I. Jaffee. Paper from "Symposium on Metallic Materials for Service at Temperatures Above 1600° F." American Society for Testing Materials. p. 111-134.

Effects of metallic and oxide additions on creep-rupture properties and on resistance to recrystallization. Zirconium dioxide, titanium dioxide and silicon were outstanding alloying additions. Micrographs, graphs, tables. 15 ref. (Q3, H general, Mo)

460-Q. Tension and Torsion Tests on Nimonic Alloys at High Temperatures. E. D. Ward and W. G. Tallis. Paper from "Symposium on Metallic Materials for Service at Temperatures Above 1600° F." American Society for Testing Materials. p. 135-145.

Apparatus and test methods for both types of test, at temperatures up to 1000° C. Graphs, table. (Q27, Q1, Ni-g)

461-Q. Thermal Fatigue Testing of Sheet Metal. H. E. Lardge. Paper from "Symposium on Metallic Materials for Service at Temperatures Above 1600° F." American Society for Testing Materials. p. 146-159; disc., p. 160-163.

Test was devised based on heating a specimen with a central hole to 1650° F. and then cooling it rapidly in a blast of cold air. The thermal cycle was based on the temperature curve of a flame tube on an engine during accelerating and decelerating conditions. Micrographs, photograph, graphs, tables, diagram. (Q7)

462-Q. Thermal Shock Testing of High-Temperature Metallic Materials. Thomas A. Hunter. Paper from "Symposium on Metallic Materials for Service at Temperatures Above 1600° F." American Society for Testing Materials. p. 164-179; disc., p. 180-182.

By means of a test using an electrical resistance heating cycle followed by a cold-air-blast shock-cooling cycle, comparative evaluations were made for 15 materials at temperatures between 1600 and 2000°F. Graphs, tables, micrographs, photographs, diagrams. 9 ref. (Q23)

463-Q. (English.) **Deformation of Thin Copper Crystals.** Hideji Suzuki, Susumu Ikeda and Sakae Takeuchi. *Physical Society of Japan, Journal*, v. 11, no. 4, Apr. 1956, p. 382-393.

Stress-strain curves of a great number of copper crystals having various radii from 0.06 to 1 mm. were measured. The range of easy glide increases considerably when the radius of the crystal decreases. Table, graphs, diagrams, 31 ref. (Q24, Cu)

464-Q. (Russian.) **A New Bearing Alloy.** N. M. Rudnitskii and A. V. Lakedemonskii. *Avtomobil'naia i Trak-*

tornaia Promyshlennost', 1956, no. 2, Feb. 1956, p. 9-12.

Antifriction properties and structure in relation to chemical composition and other factors. Comparisons with other bearing alloys, including babbits. Diagrams, photographs, graphs, micrograph, table. 3 ref. (Q9, T7, SG-c, Pb, Sb, Sn)

465-Q. (Russian.) **Use of Correlation Method to Study Interrelation Among Mechanical Properties of Various Alloy Steels.** P. V. Sklinev. *Zavodskaia Laboratoriia*, v. 22, no. 3, Mar. 1956, p. 325-329.

Use of graphic methods and equations to correlate values for mechanical properties of several steels. Tables, graph. (Q general, AY)

466-Q. (Serbian.) **Steel Products on Niobium and Tantalum Base for Aircraft Jet Engines.** Branko I. Bozic. *Glasnik Khemiskog Drushtva (Beograd)*, v. 20, no. 9, 1955, p.577-583.

Tests of stainless steel alloyed with tantalum and columbium for use in jet engine construction. Methods of production. Effect of alloying metals on mechanical properties at higher temperatures. Possibilities of replacing columbium by tantalum. Tables. 2 ref.
(Q general, T25, SS, Cb, Ta)

467-Q. (Book.) **Creep and Fracture of Metals at High Temperatures.** 419 p. 1956. Her Majesty's Stationery Office, York House, Kingsway, London, England. W.C. 2. $3.32.

Compilation of reports covering studies of plastic deformation and fracture. Pertinent papers abstracted separately. (Q3, Q26)

468-Q. (Book.) **High Temperature Properties of Materials.** Joseph Marin, editor. 92 p. 1954. Department of Engineering Mechanics, Pennsylvania State University.

Five papers, separately abstracted, presenting information relevant to recent industrial and military developments requiring materials to be used at extremely high temperatures. (Q general)

469-Q. (Book.) **Symposium on Metallic Materials for Service at Temperature Above 1600° F.** ASTM Special Technical Publication No. 174. 193 p. 1955. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. $3.50; to Members, $2.65.

Fourteen papers, separately abstracted, report progress of a wide variety of approaches to the problem of ultra-high-temperature strength. (Q general, SG-h)

R

Corrosion

217-R. Corrosion Experiments With 2S Aluminum at 200° C. W. E. Ruther. *Argonne National Laboratory (U. S. Atomic Energy Commission)*, ANL-5500, Mar. 1956, 12 p.

Lowest corrosion rates were obtained in dilute sulfuric acid at pH near 3; dichromate ion and dissolved oxygen increased the corrosion rate (neutral pH); chloride ion (5 p.p.m.) caused some pitting and increased the corrosion rate slightly; coupling to more cathodic materials such as graphite and zirconium caused no noticeable effect on the aluminum corrosion in distilled water. Tables, photograph, graphs. 2 ref. (R11, R5, R4, Al)

218-R. Integration of Corrosion Control in Pier Substructures. Carl R. Johnson. *Corrosion*, v. 12, Apr. 1956, p. 157-160.

Integration of cathodic protection in design of three piers, constructed of steel H-piling driven to rock. Details of installation, criteria of protection and other details of tests, surveys and installation. Diagrams, table. (R10, R11, SS)

219-R. A Simple Graphical Method for Checking the Adequacy of Stress Corrosion Specimen Dimensions Against Stress Concentrations. Robert H. Hay. *Corrosion*, v. 12, Apr. 1956, p. 171-173.

Simple theory, taking into account stress concentrations due to holes and fillets, is developed and reduced to a convenient, easy-to-use graphical form which is explained by examples of its use. Diagram, graph. 3 ref. (R1, R11)

220-R. The Effect of Cold Work and Heat Treatment on the Rate of Dissolution of Pure and of Impure Aluminum in Acids and Bases. M. E. Straumanis and Y. N. Wang. *Corrosion*, v. 12, Apr. 1956, p. 177-182.

Includes diagram, photograph, tables. 34 ref. (R2, Al)

221-R. The Kinetics of the Corrosion of Copper in Acid Solutions. John Randel Weeks and George Richard Hill. *Electrochemical Society, Journal*, v. 103, Apr. 1956, p. 203-208.

Kinetic data obtained show the effect of pH, dissolved oxygen chloride ion and temperature on the corrosion rate. Tables, graphs. 26 ref. (R5, Cu)

222-R. Oxidation of Aluminum in the Temperature Range 400°-600° C. W. W. Smeltzer. *Electrochemical Society, Journal*, v. 103, Apr. 1956, p. 209-214.

A vacuum microbalance technique showed that the oxidation rate decreased to a low value after a formative stage of film growth which was governed by a parabolic law. Tables, graphs. 27 ref. (R2, Al)

223-R. Erosion of Steel by Hot Gases. M. J. Fraser and A. A. Burr. *Electrochemical Society, Journal*, v. 103, Apr. 1956, p. 224-231.

A vent-plug device for producing eroded surfaces is used in the study of conditions existing in weapons during firing. Tables, graphs, photographs, micrographs. 18 ref. (R1, ST)

224-R. The Chemistry and Metallurgy of Corrosion of Metals by Fertiliser Materials. W. D. Clark. *Fertiliser Society, Proceedings, No.* 32, 1955, p. 4-22; disc., p. 22-23.

Theory of corrosion processes, resistance of metals to corrosion, corrosive propetries of fertilizers. Tables, diagrams, photographs. (R6, R7)

225-R. The Corrosion of Steels in Relation to Fertiliser Chemicals. C. R. Pipe. *Fertiliser Society, Proceedings, No.* 32, 1955, p. 31-47; disc., p. 48-49.

The corrosion of steels with special reference to fertilizer chemicals. In considering the types of steel available, reference is made to the economic factors related to their production. Photograph, diagram, micrographs, tables, graph. 15 ref. (R6, R7, ST)

226-R. Research Tackles Turbine Corrosion. F. H. Pennell. *Marine Engineering*, v. 61, Apr. 1956, p. 108-109.

Techniques for the control of erosion-corrosion. Diagram, photographs. (R1, R10, AY)

227-R. Galvanic Corrosion of Aluminum. Fred Pearlstein. *Metal Finishing*, v. 54, Apr. 1956, p. 52-57.

Corrosion of titanium, nickel, tin and cadmium in contact with aluminum. The desirability of electrodepositing cadmium or tin on copper or steel was investigated. Photographs, tables.
(R1, L17, Al, Cd, Sn, Cu, ST)

228-R. Stress-Corrosion Cracking of Stainless Steel. G. Klingel. *Metal Progress*, v. 69, Apr. 1956, p. 77-78.

Surface stress is often present in hardened stainless steel parts even after stress-relieving treatments. Removal of a thin surface layer after heat treatment can prevent stress-corrosion failures. Micrograph, photographs. (R1, SS)

229-R. Corrosion by Molten Metal. (Digest of a paper entitled "The Behavior of Materials in Aggressive Liquid Metals", by David H. Gurinsky of Brookhaven National Laboratory, read before the American Institute of Mining, Metallurgical and Petroleum Engineers, Feb. 20, 1956.) *Metal Progress*, v. 69, Apr. 1956, p. 160, 162, 164.

Mass transfer of iron in bismuth alloys studied using a simple rectangular loop of pipe. One vertical leg of this was kept hot by electrical windings; the other leg was bare and cooled by fans.
(R6, Bi, Fe)

230-R. Corrosion of Lead-Base Babbitt Alloys. (Digest of papers presented at a symposium on "Lead-Base Babbitt Bearings", sponsored by the American Society of Mechanical Engineers, 1952.) *Metal Progress*, v. 69, Apr. 1956, p. 174, 176.

Systematic tests made on machined samples of various babbitts in oil with and without oleic acid. Test temperature was held at 175° F., and oxygen was bubbled through the oil at a rate of 0.023 cu.ft. per hr. A tin-base babbitt was unaffected in all oil mixtures, and various lead-base babbitts were also practically unaffected in the plain oil. (R7, Sn, Pb)

231-R. The Corrosion of Beryllium in Simulated Cooling Water for the Materials Testing Reactor. James L. English. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission)* ORNL-772, Jan. 1951, 55 p.

Compares the corrosion resistance of extruded versus sintered beryllium tested over a period of one year, as well as the general effect of long-time exposure on extruded beryllium exposed to simulated reactor cooling water. Graphs, photographs, tables. 1 ref. (R4, Be)

232-R. Corrosion Study for a Chemical Processing Plant. I-II. Frank A. Knox. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission)*, Y-589, Aug. 1950, 30 p.

Investigates the corrosion resistant properties of various construction materials for a chemical processing plant for the production of hafnium-free zirconium using several corrosive solutions. Tables. (R6)

233-R. Cathodic Protection Teams Up With Water Treatment to Stop Corrosion. M. J. Olive. *Oil and Gas Journal*, v. 54, Apr. 16, 1956, p. 220, 223, 224, 227.

Combined system used in an East Texas gasoline plant. Diagram, tables, photographs. (R10, ST)

234-R. Corrosion Resistance of Stainless Thread Inserts in Aluminum and Magnesium Alloys. Paul E. Wolfe. *Product Engineering*, v. 27, Apr. 1956, p. 176-179.

Extensive salt-spray tests show that no finish is needed on the insert; various finishes for flange and

washer are evaluated for blind and through holes with and without bolts inserted; design suggestions for finish specifications. Photographs. 7 ref. (R11, SS, Al, Mg)

235-R. Build Corrosion Resistance Into Stainless. J. J. Heger. *Steel,* v. 138, Apr. 9, 1956, p. 116-117.

Stresses use of good fabrication design. Graph, diagrams. (R general, SS)

236-R. Corrosion, a Versatile Vandal. Bernard L. Kline. *Western Union Technical Review,* v. 10, Apr. 1956, p. 52-56.

Special cases and circumstances; chemical examination. (R general)

237-R. Some Aspects of Intergranular Corrosion of an Austenitic Stainless Steel. A. V. Shreider. *Henry Brutcher Translation No.* 3632, 14 p. (From *Zhurnal Prikladnoi Krimii,* v. 28, no. 6, 1955, p. 608-615.) Henry Brutcher, Altadena, Calif.

A study of 607 heats of this steel shows that different zones of the same sheet are susceptible. Resistance to this form of corrosion can be derived from chemical analysis and metallography. Diagrams, graph, photographs. 11 ref. (R2, SS)

238-R. (Czech.) **The Morphology of Precipitates in Titanium-Stabilized Stainless Steel.** Vladimir Cihal and Jaroslav Jezek. *Hutnické Listy,* v. 11, no. 3, Mar. 1956, p. 151-154.

Studies in connection with intergranular corrosion, after heating at high temperatures, by X-ray and electron-microscope techniques. Tables, micrographs, X-ray diffractogram. 6 ref. (R2, N7, SS)

239-R. (German.) **Corrosion of Bronze in Sandy Soil. A Contribution to Research in Corrosion.** W. Geilmann. *Angewandte Chemie,* v. 68, no. 6, Mar. 21, 1956, p. 201-211.

Disintegration of bronze in humus sandy soil is followed by analysis of a number of prehistoric bronzes. Rate is based on oxygen and carbon dioxide contents of ground waters. Tables. micrographs, photographs. 12 ref. (R8, Cu)

240-R. (German.) **Attack of Iron-Saturated Zinc Melts on Aluminum-Containing Iron.** Dietrich Horstmann. *Archiv für das Eisenhüttenwesen,* v. 27, no. 3, Mar. 1956, p. 161-163.

Relationship between time and temperature on iron with an aluminum content of up to 4.9%. Growth of iron-zinc layers. (R6, L16, Al, Fe, Zn)

241-R. (German.) **Effect of Rolled and Annealed Surface Layer on Corrosion of Steel and the Service Life of Protective Coatings.** Franz Eisenstecken. *Archiv für das Eisenhüttenwesen,* v. 27, no. 3, Mar. 1956, p. 179-185.

Role of the above surface layer in aqueous solutions and in steam boilers. Table, graphs, diagrams, photographs. 11 ref. (R4, R5, ST)

242-R. The Corrosion of Thorium in Air. M. W. Mallett and W. M. Albrecht. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* BMI-819, Apr. 1953, 17 p.

Corrosion of thorium in air in the range 100 to 900° C. follows a linear reaction rate and is principally an oxidation process. Two energies of activation were found, 13 k-cal. per mole for the 100 to 200° C. range, and 18 k-cal. per mole for the 400 to 900° C. range. These activation energies are probably caused by different rate-determining steps in the corrosion process. Graphs, photograph. 1 ref. (R2, R3, Th)

243-R. Acid-Leaching Demands Careful Design. *Chemical Engineering,* v. 63, May 1956, p. 126, 128, 130.

Protection against corrosive conditions has paid off in pioneer uranium-from-gold-slimes plant. Photographs. (R10, B14, U)

244-R. Corrosion Problems in the Marine Industry. George Fearnley. *Chemistry in Canada,* v. 8, Apr. 1956, p. 71, 72, 74.

Protective coating tests, nonferrous alloys, anticorrosive pigments, surface preparation, cleaning tests, corrosion of stern plates. 3 ref. (R3, R4, L26, ST)

245-R. Corrosion Prevention in Packaging. *Corrosion Prevention and Control,* v. 3, Apr. 1956, p. 3S + 4 pages.

Various protectives and associated products for special application, including dewatering oils and vapor phase inhibitors. Photographs. (R10)

246-R. Volatile Corrosion Inhibitors. A. B. Cox and E. C. Kuster. *Corrosion Prevention and Control,* v. 3, Apr. 1956, p. 9S-12S, 14S.

Development and uses of volatile corrosion inhibitors. Laboratory tests show how some of the factors discussed affect their use in packaging. Tables. 31 ref. (R10)

247-R. Corrosion Resistance of Some Austenitic Cr-Ni Steels of 18-8 Ti Composition. The Effect of Variation in Chemical Composition and Thermal Treatments. E. J. Heeley and A. T. Little. *Iron and Steel Institute, Journal,* v. 182, Mar. 1956, p. 241-255.

For welded chemical plant items to be exposed to onerous corrosive conditions of the 'nitric acid' type, 18-8 Ti steels having a maximum carbon content of 0.06%, with a suitable titanium-carbon ratio, are much superior to those containing 0.10% and above of carbon. Graphs, micrograph, photographs, tables. 3 ref. (R general, SS)

248-R. Studies in Corrosion. G. H. Cartledge. *Scientific American,* v. 194, May 1956, p. 35-40.

Technetium, the synthetic element found in the products of uranium fission, strongly inhibits the oxidation of iron. This phenomenon suggests a new explanation for the action of corrosion inhibitors. Photographs, diagrams, micrograph, radiograph. (R10, R2, Tc)

249-R. (French.) **Influence of Ultrasonics on the Anodic Dissolution of Metals.** René Audubert and Jacques Guitton. *Comptes Rendus,* v. 242, no. 11, Mar. 12, 1956, p. 1458-1462.

Influence of cavitation produced by an ultrasonic beam, accompanied by different electrochemical reactions at the nodes and antinodes. Micrograph, graphs. 4 ref. (R2)

250-R. (German.) **Hydrazine Application as Binder of Oxygen in High-Pressure Boiler Feed-Water.** W. Nissen. *Energietechnik,* v. 6, no. 3, Mar. 1956, p. 108-112.

Chemical properties of hydrazine. German and foreign experience in use as a corrosion inhibitor. Effect of temperature. Corrosion preventive action. 8 ref. (R10, R4)

251-R. Corrosion of Cutlery in Contact With Packing Material. E. A. Oldfield. *British Paper and Board Makers' Association, Proceedings of the Technical Section,* v. 36, pt. 3, Dec. 1955, p. 509-522; disc., p. 523-534.

Cutlery stainless steel can be corroded by high chloride content paper and board. Additional protection can be supplied to metal goods by the use of desiccating containers, inhibitors or films of plastic and petroleum derivatives. Diagram, photographs. 11 ref. (R7, R10, SS)

252-R. Corrosion Studies of Carbon Steel in Alkaline Pulping Liquors by the Potential-Time and Polarization Curve Methods. I. Theory, Methods, and Selected Results. W. A. Mueller. *Canadian Journal of Technology,* v. 34, May, 1956, p. 162-181.

Studies indicate that carbon steel immersed in strong white liquor near room temperature displays two stable states which differ in potential and corrosion rate. Theoretical principles were derived for the measurement of reproducible polarization curves and their analysis to determine the electrochemical reactions involved. Table, graphs, diagrams, photograph. 20 ref. (R5, CN)

253-R. Beneficial Effect of Alloy Additions to Zirconium on the Corrosion Resistance in 600° F. Water. D. S. Kneppel and T. T. Magel. *Massachusetts Institute of Technology, Metallurgical Project (U. S. Atomic Energy Commission),* MIT-1092, Apr. 1952, 11 p.

Results obtained have indicated that additions of iron, nickel or chromium will allow higher levels of impurities in zirconium and still maintain good corrosion resistance in 600° F. water. Effects of these alloying elements are even greater in steam corrosion. Photographs, tables. 1 ref. (R4, Zr)

254-R. Effect of Metallurgical Variables on the Corrosion of Extruded Beryllium. Arnold R. Olsen. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission),* ORNL-1146, Apr. 1952, 58 p.

Tests were made on a single vacuum cast beryllium billet which was subjected to several different treatments. Tables, graphs, photographs. (R general, Be)

255-R. (German.) **Chemical and Electrochemical Corrosion.** Heribert Grubitsch. *Zeitschrift für Metallkunde,* v. 47, no. 3, Mar. 1956, p. 184-190.

Definitions of electrochemical and chemical corrosion phenomena. The primary stage of corrosion consists in an adsorption of ions or molecules; it was found that adsorption according to Van der Waals does not contradict the electrochemical corrosion theory. Graphs, micrograph, diagram. 104 ref. (R1)

256-R. (Italian.) **On Hot Corrosion in Common Hypochlorite of 18-8 Ti, 18-8 and 18-Ti Welded Stainless Steels.** C. Bighi and G. Pancaldi. *Metallurgia Italiana,* v. 48, no. 2, Feb. 1956, p. 73-81.

Accelerated corrosion tests using samples with flat or curved surfaces in different dipping conditions. Corrosion products, dissolved in the hypochlorite, were determined by colorimetric methods. Photographs, tables, micrographs. 26 ref. (R5, SS)

257-R. (Russian.) **Effect of Impurities on the Rate of Solution of Cadmium in Hydrochloric Acid.** Ia. V. Durdin and S. A. Nikolaeva. *Leningradskogo, Universiteta, Vestnik, Seriia Fiziki i Khimii,* v. 11, no. 4, Feb. 1956, p. 83-97.

Effect of lead, iron copper, etc., as impurities on the rate of corrosion of cadmium. Relation of rate of solution of cadmium to the degree of its purification by means of fractional distillation. Effect of washing surface of cadmium with nitric acid on rate of solution of thrice-distilled cadmium. Electrochemical mechanism of the solution

of metals in acids. Tables, graphs, diagram. 15 ref. (R6, R2, Cd)

258-R. (Russian.) **Study of the Rate of Solution and the Potential of Zinc Being Dissolved in Solutions of Hydrochloric and Sulfuric Acids.** K. A. Dvorkin and Ia. V. Durdin. *Leningradskogo, Universiteta, Vestnik, Seriia Fiziki i Khimii,* v. 11, no. 4, Feb. 1956, p. 99-110.

Measuring methods. Electrochemical theory of the corrosion of metals, including the theory of local elements. Relation of rate of solution of rolled or cast specimens to temperature, concentration of acid, other factors. Tables, graphs, diagrams. 37 ref. (R1, R5, Zn)

259-R. (Russian.) **Use of the Oscillographic Method for the Study of the Kinetics of the Solution of Iron in Sulfuric Acid.** Ia. V. Durdin and V. I. Kravtsov. *Leningradskogo, Universiteta, Vestnik, Seriia, Fiziki i Khimii,* v. 11, no. 4, Feb. 1956, p. p. 127-131.

Oscillograms of the switching on and off of direct current were photographed. Equations relate the variation in potential and cathodic polarization. Graphs, table. 6 ref. (R5, R11, Fe)

260-R (Russian.) **Apparatus for Determining the Corrosive Aggressiveness of the Atmosphere.** N. D. Tomashov, G. K. Berukshtis and A. A. Lokotilov. *Zavodskaia Laboratoriia,* v. 22, no. 3, Mar. 1956, p. 345-349.

Principles and use of apparatus, consisting of a package of copper cathodic electrodes and iron anodic electrodes. Relation of current variation to relative humidity and time. Diagrams, graphs. 9 ref. (R3)

261-R. (Book-German.) **Chemical Behavior of Aluminum. Experience and Results from Research and Practice.** 333 p. 1955. Aluminum-Verlag GmbH, Dusseldorf, Germany.

Corrosion phenomena, tests, prevention and control. Behavior in contact with organic and inorganic compounds, other metals, and food, beverages, tobaccos and spices. (R general, P13, Al)

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Inspection and Control

231-S. A Rapid Chemical Method for the Determination of Lithium in Lithium-Aluminum Alloys. D. H. Purcell and G. B. O'Conner. *Argonne National Laboratory (U. S. Atomic Energy Commission),* ANL-4911, Apr. 1952, 10 p.

Volumetric method is based on the isolation of lithium by precipitation with potassium ferric periodate and an iodometric titration of the ferric iron and periodic acid liberated when the precipitate is dissolved in acid. Tables. 6 ref. (S11, Li, Al)

232-S. Radiographic Procedures for PWR-Type Fuel Elements. David E. Stutz, Merle L. Rhoten, Kenneth D. Cooley and Samuel A. Wenk. *Battelle Memorial Institute (U. S. Atomic Energy Commission),* BMI-1016, July 1955, 25 p.

Development work on techniques for radiographic inspection of the core, end cap and the cladding. Graphs, micrographs, diagrams, radiographs. (S13, Mo, U, Zr)

233-S. Automatic Control in the Steel Industry. R. W. Holman. *Blast Furnace and Steel Plant,* v. 44, Apr. 1956, p. 391-397.

Basic concepts of automation, automation in cold reduction mills, process and precipitator controls, continuous processing lines, control system types, telemetering and supervisory control. Diagrams, photographs. (S18)

234-S. Gamma Radiation From the Proton Bombardment of Boron Ten. G. B. Chadwick, T. K. Alexander and J. B. Warren. *Canadian Journal of Physics,* v. 34, Apr. 1956, p. 381-388.

Gamma rays resulting from the bombardment of B^{10} with protons of energies from 0.5 to 2.0 Mev. were observed with a sodium iodide scintillation counter. Results substantiate the findings of other investigations. Graphs. 10 ref. (S19)

235-S. The Spectrochemical Assay of Uranium-235 Using Photomultiplier Tubes. T. Lee and Lewis H. Rogers. *Carbide and Carbon Chemicals Company, K-25 Plant (U. S. Atomic Energy Commission),* K-835, Oct. 1951, 28 p.

Methods and equipment. Diagrams, photographs, tables, ultraviolet spectra. 12 ref. (S11, U)

236-S. An Economic Evaluation of the Silica Gel Adsorption Process for the Separation of Hafnium From Zirconium. W. R. Millard and R. H. Maitland. *Iowa State College, Ames Laboratory (U. S. Atomic Energy Commission),* ISC-268, Aug. 1952, 11 p.

Cost of silica gel reclamation, current status, costs, and possible cost reductions in adsorption process. 7 ref. (S11, Zr, Hf)

237-S. The Use of the High Current Mercury Cathode in Uranium Determination. J. Gurney, T. W. Bartlett, E. D. Marshall and R. H. Lafferty, Jr. *Carbide and Carbon Chemicals Company, K-25 Plant (U. S. Atomic Energy Commission),* K-1106, Feb. 1954, 28 p.

Electrolysis with a mercury cathode operating at 20 amp. was tested as a method for rapid purification of uranium solution prior to volumetric determination. Graphs, diagrams. 19 ref. (S11, U)

238-S. A Study of the Separation of Hafnium and Zirconium Using TTA. Dorothy C. McCarty, Burton E. Dearing and John F. Flagg. *Knolls Atomic Power Laboratory (U. S. Atomic Energy Commission),* KAPL-180, Apr. 1949, 45 p.

Extraction in a nitric acid system studied as a function of acidity and thenoyltrifluoroacetone concentration. Tables, diagram, graphs. (S11, Hf, Zr)

239-S. The Determination of Vanadium in the Presence of Plutonium. Maynard E. Smith. *Los Alamos Scientific Laboratory (U. S. Atomic Energy Commission),* LA-1285, Aug, 1, 1951, 26 p.

Polarographic method does not require a separation of the plutonium. Hydrochloric acid solutions containing both plutonium and vanadium are treated with zinc and zinc amalgam prior to analysis to reduce both metals. The plutonium is reduced to the (III) state and the vanadium chiefly to the (II) state. Diagram, graphs, photographs, tables. 6 ref. (S11, Pu, V)

240-S. The Spectrophotometric Determination of Thorium in Uranium. Maynard E. Smith. *Los Alamos Scientific Laboratory (U. S. Atomic Energy Commission),* LA-1897, Apr. 1955, 16 p.

Method involves separation of the uranium from the thorium by complexing the thorium with Versene and precipitating the uranium as the peroxide. Graph, tables. 10 ref. (S11, Th, U)

241-S. British Standards for Aluminium and Alloys—1955 Revisions. E. Elliott. *Metallurgia,* v. 53, no. 317, Mar. 1956, p. 108-112.

Summarizes major changes in revisions of B.S. 1470-1477 and B.S. 1490. Tables. 4 ref. (To be concluded.) (S22, Al)

242-S. New Thermocouple for Service in Reducing Atmospheres. Charles L. Guettel. *Metal Progress,* v. 69, Apr. 1956, p. 89-90.

Two new thermocouple alloys are more resistant to the corrosive attack of reducing gas and retain thermal e.m.f. stability longer than conventional base-metal thermocouples. Graph. (S16, SG-a)

243-S. Development of Radiation Pyrometry Techniques for Measurement of Temperature During the Rolling of Uranium. C. W. Ricker, H. F. Schaf and J. V. Werme. *Minneapolis-Honeywell Regulator Company, Brown Instruments Division (U. S. Atomic Energy Commission),* NYO-3454, May 1953, 74 p.

Laboratory facilities, radiomatic radiation detector, emittance of uranium as rolled and emissivity of the metal; calibration procedures. Tables, photographs, graphs. 4 ref. (S16, F23, U)

244-S. Mathematical Foundations of Non-Destructive Testing by Eddy Current Methods. Richard Hochschild. *New York Operations Office (U. S. Atomic Energy Commission),* NYO-3576, Mar. 1953, 84 p.

Electromagnetic field equations, field distribution, impedance and eddy currents in a solid homogeneous cylindrical conductor, nonuniform permeability and multiple component cylinders, some eddy current tests and their analyses. Diagrams, tables, graphs. (S13)

245-S. Summary of Stable Isotope Production and Chemistry Procedures. H. W. Savage and Boyd Weaver. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission),* Y-565, Feb. 1950, 29 p.

Information showing charge materials used, primary calutron problems, practicability of calutron isotope separation, collector pocket material, methods for chemical refinement of the product. Tables. (S19)

246-S. Analytical Determination of Trace Constituents in Metal Finishing Effluents. XIII. The Volumetric Determination of Sulfate in Effluents. E. J. Serfass and R. F. Muraca. *Plating,* v. 43, Apr. 1956, p. 500-501.

Volumetric procedure for determination of sulfate in effluents in the range of 5 to 50 ppm.; method makes use of a combination of hydroxide and silver ion precipitations to remove ions which might interfere with the indicator for the titration. (S11, L general)

247-S. Use of Ion Exchange for the Separation of Uranium From Ions Interfering in Its Colorimetric Determination. Sallie Fisher. *Rohm and Hass Company, Research Laboratories (U. S. Atomic Energy Commission),* RMO-2530, May 1954, 32 p.

In sulfate solutions uranium is absorbed on an anion exchange resin and eluted with perchloric acid. Interfering metals are pre-reduced to forms not retained by the resin. Tables, photograph. (S11, U)

248-S. Application of the Ion Exchange Separation of Uranium to the Analysis of Ores. Sallie A. Fisher. *Rohm and Haas Co., Research Laboratories (U. S. Atomic Energy Commission),* RMO-2531, Aug. 1954, 14 p.

Analytical separation of uranium from interfering elements by ion ex-

change using Amberlite IRA-400 has been extended to include ores as well as solutions. Tables. (S11, U)

249-S. A Spectrophotometric Method for Determining Small Amounts of Beryllium in Uranium. Maynard E. Smith. *U. S. Atomic Energy Commission, Research and Development Report,* LA-1585, Aug. 1953, 26 p.

Method is based on extraction of beryllium acetylacetone complex from uranium carbonate solutions. Photograph, graphs, tables. 12 ref. (S11, U, Be)

250-S. The Possible Use of Paper Chromatography and Radioactive Reagents in Ultramicro Inorganic Analysis, With Special Reference to Uranium and Plutonium. Robert M. Fink and Kathryn F. Fink. *University of California, Atomic Energy Project (U. S. Atomic Energy Commission),* UCLA-30, June 1949, 26 p.

The best reagent would be one which was relatively insoluble in organic reagents (low R.F. value) but which would yield stable compounds of relatively high R.F. values with the substances under investigation. Tables, diagram, radioautographs, 2 ref. (S11, U, Pu)

251-S. Progress in Ultrasonic Examination. II. New Techniques and New Equipments. C. W. J. Vernon *Welding and Metal Fabrication,* v. 24, Apr. 1956, p. 124-133.

A review. Use of barium titanate, directional probes, and recorders. Field examinations. Diagrams, photographs, radiograph, sonogram. 4 ref. (S13)

252-S. Non-Destructive Testing of Metals. G. H. Thurston. *Western Machinery and Steel World,* v. 47, Apr. 1956, p. 112-115.

Radiography, magnetic particle inspection, ultra-sound, penetrant methods. Diagrams, photographs. (S13)

253-S. Separation of Vanadium From Titanium and Iron With a Cationite. L. M. Orlova. *Henry Brutcher Translation No.* 3654, 3 p. (From *Zavodskaya Laboratoriya,* v. 21, No. 1, 1955, p. 29-30.) Henry Brutcher, Altadena, Calif.

Vanadium is eluted as vanadium (V) by the presence of hydrogen peroxide in excess while titanium and iron salts are absorbed on the resin. Table. (S11, Fe, Ti, V)

254-S. Determination of Gases in Steel by Vacuum Fusion. Absorption of Gases by the Furnace. Shigeki Sawa. I. *Henry Brutcher Translation No.* 3647, 12 p. (From *Tetsu to Hagané,* v. 38, no. 8, Aug. 1952, p. 567-571.) II. *Henry Brutcher Translation No.* 3648, 19 p. (Abridged from *Tetsu to Hagané,* v. 38, no. 9, Sept. 1952, p. 672-678.) Henry Brutcher, Altadena, Calif.

An improved form of graphite spiral resistor furnace for vacuum fusion and determination of oxygen, nitrogen, and hydrogen contents of steels. Rate of pumping furnace temperature for best results. Tables, diagrams, graphs. 4 ref. (S11, ST)

255-S. (German.) **Determination of Zinc in Aluminium.** E. Steuer. *Aluminium,* v. 32, no. 4, Apr. 1956, p. 205-208.

The zinc in aluminum and its alloys, bauxite, alumina and various secondary materials in the production of aluminum, determined polarographically with sodium pyrolidinedithiocarbamate. Tables. 3 ref. (S11, Zn, Al)

256-S. Determination of Fluoride in Chromium Plating Solutions. Joseph P. Branciaroli and June G. Coleman. *Analytical Chemistry,* v. 28, May 1956, p. 803-804.

Method separates fluoride by precipitating the interfering metal ions; it may be adaptable to other analytical problems. Graph, tables. 7 ref. (S11, L17, Cr)

257-S. Spectrophotometric Determination of Zirconium in Thorium. Louis Silverman and Dorothy W. Hawley. *Analytical Chemistry,* v. 28, May 1956, p. 806-808.

At a controlled high acidity, zirconium in the amount of 0.005 to 0.350% can be determined colorimetrically using alizarin red S. Graph, tables. 14 ref. (S11, Th, Zr)

258-S. Thoron—Tartaric Acid Systems for Spectrophotometric Determination of Thorium. F. S. Grimaldi and Mary H. Fletcher. *Analytical Chemistry,* v. 28, May 1956, p. 812-816.

Three tartaric acid-thoron systems differ with respect to the concentrations of thoron and tartaric acid. Mesotartaric acid is most effective in masking zirconium. The behavior of rarer elements, usually associated with thorium ores, is determined in two systems, and a dilution method is described for the direct determination of thorium in monazite concentrates. Graphs, tables. 7 ref. (S11, Th)

259-S. Flame Photometric Determination of Calcium in Furnace Slag. G. W. Standen and C. B. Tennant. *Analytical Chemistry,* v. 28, May 1956, p. 858-860.

Developed for rapid determination for calcium in the range of 30% by wt. Total elapsed time required for the flame analysis is 2 hr. Graph, tables. 5 ref. (S11, Ca)

260-S. Determination of Nickel in Oxidized Films on Nickel Metal. B. D. Brummet and R. M. Hollweg. *Analytical Chemistry,* v. 28, May 1956, p. 887-888.

The solvent used, 0.5% potassium cyanide, dissolves the oxidized film but not the nickel metal. Method is sensitive to microgram quantities of nickel. Graphs. 5 ref. (S11, Ni)

261-S. Statistical Controls. A Valuable Tool for Reducing Costs. Kenneth M. Smith. *Foundry,* v. 84, May 1956, p. 138-141.

A simple and practical method of controlling foundry variables. Graphs, table. (S12, E general)

262-S. System for Continuous Measurement of Oxygen in Open Hearth Furnaces. *Industrial Heating,* v. 23, Apr. 1956, p. 780, 782, 784, 786.

Designed for use with magnetic type oxygen analyzer, the new system solves the difficult problem of obtaining a continuous, dirt-free sample with a minimum of maintenance. Diagrams, photographs. (S11, D2)

263-S. Use of the Spectrograph in Fabrication Shops. Howard E. Boyer and Frank E. Fitzgerald. *Iron and Steel,* v. 29, Mar. 1956, p. 99-103.

A review of spectrochemical analysis; steps which are necessary in the establishment of a spectrographic set-up in a metal-working shop. Graphs, photographs, tables. (S11)

264-S. Nondestructive Testing of Electrical Forgings. R. H. Leith and F. H. Oberlin. *Nondestructive Testing,* v. 14, Mar.-Apr. 1956, p. 14-16.

Magnetic particle and visual bore methods, application of some testing methods, special advantages of ultrasonics. Photographs. (S13)

265-S. The Photographic Monitoring of Stray X-Ray in the Radiography of Metals. R. B. Wilsey, D. H. Strangways and G. M. Corney. *Nondestructive Testing,* v. 14, Mar.-Apr. 1956, p. 18-23.

Method of monitoring stray radiation by means of photographic films carried by personnel; variation of film response with quality of radiation; possibility of secondary radiation from iron and lead (walls and shielding); film-calibration procedures. Graph, diagrams, tables. 11 ref. (S13, Fe, Pb)

266-S. The Application of Cesium-134 to Industrial Radiography. James W. Dutli and Dana E. Elliott. *Nondestructive Testing,* v. 14, Mar.-Apr. 1956, p. 24.

Cesium-134 has two of the three basic requirements for a practical, high-gamma-energy, radiographic source; long half-life and high specific activity. An experimental radiographic evaluation was made to verify its predicted usefulness. Diagram, graphs, radiographs, photographs, tables. 7 ref. (S13, Al, Cs, ST)

267-S. Ionography; A New Process of Radiographic Imaging. E. L. Criscuolo and D. T. O'Connor. *Nondestructive Testing,* v. 14, Mar.-Apr. 1956, p. 28-30.

System utilizes differential X-ray ionization of a layer of air immediately above a charged insulating surface, creating an electrostatic image corresponding to the differential ionization pattern and made visible by liquid deposition of fine particles. Offers significant advantages in speed and economy by virtue of its being a completely daylight process using an inexpensive reusable plate. Diagrams, graphs, photographs, tables. 5 ref. (S13)

268-S. Nomograms for Iridium-192 Radiography. Jerome G. Morse. *Nondestructive Testing,* v. 14, Mar.-Apr. 1956, p. 32-33.

Nomograms enable the decay of iridium-192 as a function of time, and the exposure time for radiography with iridium as the source of radiation to be estimated fairly accurately. Nomograms. 3 ref. (S13, Ir)

269-S. Specifications for Cold Rolled Strip Steel. Göran Molinder. *Sheet Metal Industries,* v. 33, no. 347, Mar. 1956, p. 203-204, 214.

Some views about specifications for cold rolled strip steel; information on standardization work going on in Sweden. (S22, F23, ST)

270-S. Electronic Inspection of Continuous Strip. Leo Walter. *Sheet Metal Industries,* v. 33, no. 347, Mar. 1956, p. 205-208.

With the application of photoelectric tubes, continuous automatic inspection has become possible for rapidly moving metal strips during rolling or continuous surface finishing, such as trimming and the like. Diagrams, photograph. 5 ref. (S14, F23)

271-S. (English.) **Spectrochemical Analysis of Gray and White Cast Iron.** C. Georg Carlsson. *Jernkontorets Annaler,* v. 140, no. 2, 1956, p. 137-147.

A direct-reading method gives high accuracy in determination of silicon in gray iron. Tables, diagram, graphs. 13 ref. (S11, Si, CI)

272-S. (English.) **Determination of Micro-Amounts of Indium in Zinc and in Gallium by Radioactivation.** J. Hoste and H. van den Berghe. *Mikrochimica Acta,* 1956, nos. 4-6 p. 797-803.

A method to determine microamounts of indium in zinc and gallium by radio-activation analysis, using 1 g. radium-barium as thermal-neutron source. Tables. 2 ref. (S11, In, Zn, Ga)

273-S. (English.) **Determination of Tin in Bismuth.** Ilana Levitan. *Spectrochimica Acta,* v. 7, no. 6, Mar. 1956, p. 395-396.

A method for determination of 0.01 to 1.00% of tin in bismuth. Analyses may be carried out with samples as small as 0.02 g. Graphs. 1 ref. (S11, Sn, Bi)

274-S. (Dutch.) **Comparison Between Material Testing by Means of Ultrasound as Continuous Sound and as Sound Impulses.** A. de Sterke. *Metalen,* v. 11, no. 4, Feb. 29, 1956, p. 77-86, disc., p. 86-89.

Historical review. Details of continuous-sound method and impulse or reflection method. Specialized applications of both. Diagrams, table. (S13)

275-S. (French.) **Applications of Radio-Elements to Problems of Very High Purity Metals.** Ph. Albert. *Chimie & Industrie,* v. 75, no. 2, Feb. 1956, p. 275-286.

Methods of analysis. Radio-elements used as "tracers" allow studies on the kinetics of the elimination of an element from a metal undergoing a purifying treatment. Elimination of carbon from iron by annealing in pure hydrogen. Tables, graphs, micrographs, diagrams, autoradiographs. 22 ref. (S19)

276-S. (French.) **Separation of Niobium and of Tantalum by Paper Chromatography.** E. Bruninx, J. Eeckhout, and J. Gillis. *Mikrochimica Acta,* 1956, nos. 4-6, p. 689-699.

The separation of niobium and tantalum on the microscale by paper chromatography. Various organic liquids were used as eluants. Tables, graphs, diagram. 7 ref. (S11, Cb, Ta)

277-S. (Polish.) **Technical Analysis of Amidosulphonic Acid.** M. Oktawiec. *Prace Instytutow Ministerstwa Hutnictwa,* v. 8, no. 1, 1956, p. 43-47.

A method and a simple apparatus which make possible a quick and sufficiently accurate determination of amidosulfonic acid both in the electrolytic bath used in refining of lead and in the technical product. Tables, diagram, photograph. 8 ref. (S11, C23, Pb)

278-S. (Russian.) **Chemical Separation and Analysis of Metallic Compounds in Some Nickel-Based Alloys.** R. B. Golubtsova and L. A. Mashkovich. *Doklady Akademii Nauk SSSR,* v. 106, no. 6, Feb. 21, 1956, p. 1011-1014.

Analysis of anode powders of binary alloys. Solubility of solid solutions in acid-methanol mixtures. Measurements of potential differences. Tables, graph. 8 ref. (S11, Ni, Ti)

279-S. (Russian.) **Automatization of Continuous Teeming of Steel.** *Stal',* v. 16, no. 3, Mar. 1956, p. 212-214.

Application of synthetic-radioactive isotopes to reliable devices for measurement and control of the level of the liquid metal. Photographs, diagrams. (S18, D9, ST)

280-S. (Russian.) **Determination of Cobalt and Nickel in Manganese Ores and Slags by Means of Ethyl Xanthate.** A. T. Pilipenko and V. A. Bogoliubskii. *Ukrainskii Khimicheskii Zhurnal,* v. 22, no. 1, 1956, p. 97-99.

Calorimetric determination of small quantities of cobalt. Separation of nickel in the form of ethyl xanthate complexes. Tables, graph. 7 ref. (S11, Co, Ni, Mn)

281-S. (Russian.) **Radioactive Methods of Metallophysical Investigations.** N. T. Gudtsov, L. I. Ivanov and M. P. Matveeva. *Vestnik Akademii Nauk SSSR,* v. 26, no. 3, Mar. 1956, p. 79-83.

Method and apparatus provide data for calculating evaporation rate and sublimation temperature; diffusion coefficients and diffusion activation energy; vapor pressure of pure iron, iron in alloys with chromium, and other iron alloys. Diagrams. (S19, P12, N1, Fe)

282-S. (Spanish.) **Rapid Determination of the Cobalt in Steels.** Faustino Velasco and Joaquin Hontoria. *Instituto del Hierro y del Acero,* v. 9, no. 43, Feb. 1956, p. 176-182.

A colorimetric and spectrophotometric method. Blue color formed by cobalt ion with the thiocyanate ion is extracted with cyclohexanone. Interference of the iron is eliminated by the use of ammonium citrate and disodium phosphate. Tables, graphs. 16 ref. (S11, ST, Co)

283-S. **The Quality of Radiographic Inspection.** D. T. O'Connor and E. L. Criscuolo. *ASTM Bulletin,* 1956, no. 213, Apr. 1956, p. 53-59.

An analysis of present radiographic requirements on a relative and on an absolute scale, from the point of view of radiographic coverage. A simple revision of existing penetrameter design and use which will permit three basic radiographic quality levels to be gaged simply and directly is proposed. Tables, graphs. 16 ref. (S13)

284-S. **Small Shop Fights Back With Casting Quality.** A W. Schneble. *Iron Age,* v. 177, May 3, 1956, p. 98-99.

Statistical quality control, plus a tailored cost accounting system, help small job shops control quality. Diagram, graph. (S12, E general)

285-S. **Rapid Procedure for the Determination of Calcium.** Joseph R. Simmler. *Mallinckrodt Chemical Works, (U. S. Atomic Energy Commission)* NYO-5244, Mar. 1951, 9 p.

A gravimetric system with precipitation of the calcium in an ethylmethyl alcohol and a rapid semimicro volumetric scheme presented. Tables. (S11, Ca)

286-S. **Application of X-Ray Fluorescence to Analysis of Zirconium in Uranium.** W. F. Peed, W. B. Wright, Jr., and G. L. Rogosa. *Oak Ridge National Laboratory, (U. S. Atomic Energy Commission),* ORNL-1419, Dec. 1952, 15 p.

A rapid instrumental method. The precision and accuracy compare favorably with conventional methods. Tables, graphs. 4 ref. (S11, U, Zr)

287-S. **An Indirect Colorimetric Method for the Determination of Uranium.** D. L. Manning and J. C. White. *Oak Ridge National Laboratory (U. S. Atomic Energy Commission),* ORNL-1476, Jan. 1953, 22 p.

An indirect colometric method for the determination of uranium in the range 50 to 400 γ in a volume of 50 ml. based on the oxidation of uranium (IV) to uranium (VI) with iron (III) and determination of the iron (II) thus formed. Tables. 8 ref. (S11, U)

288-S. **How to Choose the Right Copper.** *Steel,* v. 138, May 7, 1956, p. 94-97.

Commercially available coppers and their engineering properties. Table, graphs, photographs. (S22, Cu)

289-S. **Temperature Control of Heat Treating Furnaces. VI. Special Systems.** R. M. Sills. *Steel,* v. 138, May 7, 1956, p. 116-117, 120.

Two-point, program, front setter, cascade and protection systems are supervisory controls that are frequently necessary. Photographs, diagrams. (S16, J general)

290-S. **Gear Gaging Goes Automatic.** T. S. Gates. *Tool Engineer,* v. 36, May, 1956, p. 95-99.

Automatic gear gages which check gears for size, eccentricity, helix angle, full-tooth and tooth thickness in various combinations and with electronic sound-discriminating devices which reject noisy gears. Diagrams, photographs. (S14)

291-S. **Determination of Chromium in Plutonium.** Maynard E. Smith. *University of California, Los Alamos Scientific Laboratory (U. S. Atomic Energy Commission),* AECD-4171, Apr. 1955, 27 p.

As little as 10 ppm. of chromium may be determined by the method. Standard deviations of 7 to 1 relative % were obtained for chromium concentrations of 40 ppm. to 1% respectively. Graphs, tables. 11 ref. (S11, Pu, Cr)

292-S. **Aluminum Sheet and Plate Alloys.** *Welding Engineer,* v. 41, May, 1955, p. 97.

Tabulated data covering major alloying elements, cladding alloy, forms produced and federal, military, A.S.T.M. and aeronautical specifications. Table. (S22, Al)

293-S. **Temperature and Its Measurement.** Paul H. Dike. Paper from "High-Temperature Technology". John Wiley & Sons. p. 335-382.

Pyrometry by radiation methods; high-temperature thermocouples and absolute noise thermometer. Diagrams, graphs, photograph, tables. 26 ref. (S16)

294-S. (German.) **Determination of Magnesium in Irons.** R. Reichert. *Zeitschrift für Analytische Chemie,* v. 150, no. 4, 1956, p. 250-253.

A fast titrimetric method using the disodium salt of ethylenediaminotetraacetic acid. Table. 16 ref. (S11, Mg, Fe)

295-S. (German.) **Spectrophotometric Micro Determination of Silicon in Cathode Nickel.** W. Gan. *Zeitschrift für Analytische Chemie,* v. 150, no 4, 1956, p. 254-263.

Method of determination of silicon within an exactness of ±5% at a silicon content of 0.200 to 0.005%, and with an accuracy of 10% at a silicon content of less than 0.005%. Graphs, tables. 15 ref. (S11, Ni, Si)

296-S. (Italian.) **Analysis of Aluminum in 75-80% Ferrosilicon.** Francesco Baldi and Raffaeallo Passeri. *Metallurgia Italiana,* v. 48, special supplement to no. 1, Jan. 1956, p. 8-14.

Method of analyzing powdered materials using a rotating electrode. Micrographs, graphs, photographs. 10 ref. (S11, Al, Fe, Si)

297-S. (Italian.) **On Some Causes of Error in the Spectrographic Analysis of Steels.** Bartolomeo Morello. *Metallurgia Italiana,* v. 48, special supplement to no. 1, Jan. 1956, p. 15-20.

Evaluation of errors caused by variations in equipment and materials. Graphs, tables, micrographs, 22 ref. (S11, St)

298-S. (Italian.) **Test Sample Pouring and Preparation in the Quantometric Analysis of Cast Iron.** Venceslao Pavanelli. *Metallurgia Italiana,* v. 48, special supplement to no. 1, Jan. 1956, p. 40-42.

Reproducibility of determinations on samples chilled by different methods. Diagram, tables, micrographs, photograph. 3 ref. (S11, CI)

299-S. (Italian.) **First Approach to Spectrographic Analysis of Copper-Base Alloys.** E. Baltera and M. L. Soragna. *Metallurgia Italiana,* v. 48, special supplement to no. 1, Jan. 1956, p. 43-47.

Sample preparation. Comparison of results obtained with two different spark dischargers. Examination of spark prints on test samples. Diagrams, micrographs, graphs. 8 ref. (S11, Cu)

300-S. (Russian.) **Apparatus for the Precise Measurement of High Temperatures.** V. V. Kandyba. *Izmeritel'naia Teknika,* 1956, no. 1, Jan.-Feb. 1956, p. 36-38.
Characteristics and accuracy of pyrometers of various types used in the Soviet Union. Photograph. (S16)

301-S. (Russian.) **Measuring the Temperature of Liquid Steel.** *Zavodskaia Laboratoriia,* v. 22, no. 3, Mar. 1956, p. 259-261.
Survey of methods of using thermocouples composed of platinum alloys with varying amounts of rhodium in the Soviet area and abroad. Movement toward automation. (S16, D general, SG-a, ST)

302-S. (Book.) **The Analysis of Minerals and Ores of the Rarer Elements.** W. R. Schoeller and A. R. Powell. (3rd Ed. Rev. by A. R. Powell.) 408 p. 1955. Hafner Publishing Co., 31 E. 10th St., New York, N. Y.
Latest developed analytical methods, manual for analytical chemists, metallurgists and advanced students. (S11)

303-S. (Book.) **Proceedings of the International Conference on the Peaceful Uses of Atomic Energy.** Applications of Radioactive Isotopes and Fission Products in Research and Industry, v. XV, 327 p. 1956. United Nations, New York. $7.50.
Compilation of papers covering radioactive isotopes in research, control and technology, and fission products and their applications. (S19)

T
Applications of Metals in Equipment

128-T. Stainless vs. Titanium for High Speed Aircraft. R. G. Sloan, *Materials & Methods,* v. 43, Apr. 1956, p. 124.
Precipitation hardening stainless steels and titanium alloys can meet the severe conditions of supersonic flight. Comparison of strength-weight characteristics indicates their relative suitability for such applications. Photograph. (T24, Q23, SS, Ti)

129-T. Selection and Application of Spring Materials. Harold C. R. Carlson. *Mechanical Engineering,* v. 78, Apr. 1956, p. 331-334.
Data on spring steels (carbon, alloy and stainless), and copper-base, nickel-base, and special alloys which should simplify choice. Tables, graph. (T7, SG-b, ST, AY, SS)

130-T. New Gas Turbine Alloy. (Digest of "Engineering Requirements for Jet Engine Materials", by D. K. Hanink, F. J. Webbere and A. L. Boegehold; presented at Society of Automotive Engineers meeting, Jan. 1955.) *Metal Progress,* v. 69, Apr. 1956, p. 132, 134, 136.
New nickel-base high-temperature alloy which has higher strength and lower content of strategic alloying elements than other turbine-blade alloys. Graphs. (T25, Ni)

131-T. Taming Supersonic Heat. *Steel,* v. 138, Apr. 9, 1956, p. 112-114.
Development of special molybdenum, magnesium and titanium alloys, refractory and oxidation resistant coatings and reinforced plastics for application in guided missiles and supersonic aircraft. Graphs, photographs. (T24, Mg, Ti, Mo)

132-T. Modelling in Pewter Sheet. *Tin and Its Uses,* 1956, no. 34, p. 1-3.
Tools and methods used in making ornaments, trinket boxes and jewelry, from pewter foil. Photographs. (T10, Sn)

133-T. Best Designs for Lead Installations. IV. M. M. Hoover. *Chemical Engineering,* v. 63, May 1956, p. 226-230.
Recommended practice for the fabrication of high-velocity coolers, homogeneous lead linings and lead specialties for use with corrosives. Diagrams. (T29, Pb)

134-T. Arctic Ice Barrier "Crashed" With Nickel-Aluminum Bronze Propellers. J. S. Vanick. *INCO,* v. 26, Mar. 1956, p. 2-6.
New material resists corrosion, has high strength with less weight. Photographs, tables. (T22, Cu)

135-T. Ductile Cast Iron Proves Itself in Kennedy Valve Tests. *INCO,* v. 26, Mar. 1956, p. 12-15.
Standard 6-in. valve bodies tested in bending at 900° F., and under drop-impact tests at 40° F. Photographs. (T7, Q5, Q6, CI)

136-T. Materials Handling at High Temperature Mechanized With Cast High Nickel Alloy Heat-Treating Parts. *INCO,* v. 26, Mar. 1956, p. 26-29.
Diversified operations illustrate how modern high-volume heat treating practice is being mechanized with the aid of high-alloy castings; carburizing, normalizing, hardening, annealing. Photographs. (T5, A5, J general, Ni)

137-T. Alloy Steels Extend Machine Tool Service Life. R. T. Hook. *Iron Age,* v. 177, Apr. 26, 1956, p. 101-103.
Nickel alloy steels for highly stressed turret lathe components; chief use is for parts that need core toughness under a hard case. Diagrams. (T5, AY)

138-T. Practical Selection Data for Sleeve Bearing Materials. J. B. Mohler. *Machine Design,* v. 28, May 3, 1956, p. 105-107.
Tabulated data of known properties of existing bearing materials. Graph, photograph, tables. (T7)

139-T. Magnesium Makes Better Motors. J. T. Howes. *Modern Metals,* v. 12, Apr. 1956, p. 46, 48.
Significant savings in weight, metal cost and machining time result from company's switch from aluminum and zinc. New hot chamber machine die-casts 600 end frames per hour. Photographs, tables. (T1, E13, Mg)

140-T. Aluminum for Marine Switchgear. H. F. Harvey, Jr., and E. J. Dawson. *Power Apparatus and Systems,* 1956, no. 23, Apr. 1956, p. 134-140; disc., p. 140-142.
Advantages of the use of aluminum; comparisons; problems involved in its application to switchgear. 6 ref. (T1, Al)

141-T. (French.) **Light-Alloy Honeycomb and Application to Sandwich Construction.** *DOCAERO; Revue Documentaire de la Technique Aéronautique Mondiale,* 1956, no. 37, p. 39-56.
Composition, production and inspection of light-alloy honeycomb and metallic sandwiches; mechanical characteristics. Diagrams, photographs, tables, 10 ref. (T24, T26, Q general)

142-T. (Polish.) **Bimetallic Bearing Strips: Steel-CuSn4Zn4Pb2.5.** S. Balicki. *Prace Instytutow Ministerstwa Hutnictwa,* v. 8, no. 1, 1956, p. 40-42.
Principles of production of steel-bronze bimetallic strips; cold working, consisting of cold rolling, interoperational annealing, and pickling. Micrographs, diagram. 5 ref. (T7, ST, Cu)

143-T. The Development of Metal-Bonded Carbon Bearings. Harvey B. Nudelman, Cord H. Sump and Walter C. Troy. *ASTM Bulletin,* 1956, no. 213, Apr. 1956, p. 62-69.
A new metal-bonded carbon bearing was developed to combine the desirable properties of carbon and metallic materials. Emphasis was placed on the interpretation of wear technology in bearing research. Photographs, tables, graphs, micrographs. 15 ref. (T7, Q9, C)

144-T. Metallurgy of Automatic Transmission Gears. William G. Mertens and Frank Zuzich. *Automotive Industries,* v. 114, May 1956, p. 66-70, 102.
Raw materials, heat treatment and physical properties of various types of gears; future developments. Tables, photographs. (T21)

145-T. Applications of Aluminum Impacts. Bernard F. Wade. *Electrical Manufacturing,* v. 57, May, 1956, p. 95-99.
Designers have extended the use of these versatile parts to a wide range of electrical and electronic assemblies. Design highlights and several new applications. Diagrams, photographs, tables. (T1, G5, Al)

146-T. High-Temperature, Foil-Type Tantalum Capacitors. David B. Peck, Stanley W. Bubriski and Walter W. Schroeder. *Electrical Manufacturing,* v. 57, May, 1956, p. 134-135, 364.
Developed for reliable continuous operation at 125° C. Design calls for a rolled tantalum-foil capacitor section, impregnated with a non-aqueous, organic-type electrolyte, sealed in a tubular aluminum housing with a special Teflon-rubber triple-spun gasket. Graphs, photographs, table. (T1, Ta)

147-T. Feasibility Survey of Zirconium and Alternate Reactor Structural Materials for High Temperature Operation. S. H. Bush and R. K. Kemper. *Hanford Atomic Products Operation (U. S. Atomic Energy Commission),* AECD-3788, Nov. 1953. 40 p.
Zirconium, aluminum and steel compared on the basis of 100, 200, 300 and 700 Area problems. Zirconium or Zircaloy-2 appear to be the most satisfactory materials for tubes in a high-temperature high-pressure reactor. Graphs, tables. 36 ref. (T25, Al, Fe, Zr)

148-T. Nondefense Uses of Titanium. L. J. Barron. *Light Metal Age,* v. 14, Apr. 1956, p. 16-19.
Good corrosion resistance leads to applications in the food, paper, power, marine, automotive and anodizing industries. Photographs. (T general, Ti)

149-T. Meehanite Metal as a Gear Material. C. R. Austin. *Pulp and Paper Magazine of Canada,* v. 57, Apr. 1956, p. 131-135.
Nature of meehanite metal, properties, response hardening by quenching in water, dimensional stability; industrial applications. Diagrams, graphs, photographs, tables. (T7, CI)

150-T. Some Sheet and Bucket Materials for Jet-Engine Application at 1600° F. and Higher. J. P. Denny, L. P. Jahnke, E. S. Jones and F. C. Robertshaw, Jr. Paper from "Symposium on Metallic Materials for

Service at Temperatures Above 1600° F." American Society for Testing Materials, p. 3-15.

Data on mechanical properties, physical constants, and surface and structural stability, which are believed to be representative of the highest caliber of materials currently available. Graphs, tables. 1 ref. (T24, SG-h)

151-T. (Book.) **Steel Extrusion Experiments on Airframe Components. Phase IV Report.** K. A. Wilhelm. 21 p. + 39 plates. 1955. Lockheed Aircraft Corp., Burbank, Calif.

Industrial practice in the production of steel and titanium extrusions for airframe components; production and procurement problems affecting both user and producer. (T24, F24, ST, Ti)

V

Materials

General Coverage of Specific Materials

85-V. Preparation of Irradiation Specimens of the Uranium-Chromium Eutectic Alloy. H. A. Saller, R. F. Dickerson and W. E. Murr. *Battelle Memorial Institute, (U. S. Atomic Energy Commission)*, BMI-945, Aug. 1954, 19 p.

Casting methods and fabrication techniques used for the production of reactor specimens. Tables, photographs, diagrams. (T25, Cr, U)

86-V. The New Stainless Steels. D. B. Roach and A. M. Hall. *Materials & Methods*, v. 43, Apr. 1956, p. 137-152.

Mechanical engineering data for new steels that save on strategically scarce materials or provide special properties. Properties and applications are considered for the high-manganese, extra-low-carbon and the precipitation-hardenable grades, and ferritic steels for elevated temperature service. Photographs, tables. (SS)

87-V. The Rare Earths Up From Obscurity. R. C. Vickery. *Research & Engineering*, v. 2, Apr. 1956, p. 28-33.

The development of rare-earth chemistry, separation techniques, properties, present and future applications. Graphs, photograph, table. (EG-g)

88-V. (German.) **Production and Hardening of Iron-Cobalt-Zinc Alloys.** Werner Köster and Heinz Schmid. *Archiv für das Eisenhüttenwesen*, v. 27, no. 3, Mar. 1956, p. 211-217.

Microscopic and magnetic investigation for production of the three-element system; determination of smelting equilibria and reaction processes. Characterization of phase changes in solid state by means of sections at 500, 650 and 800° C. Hardness investigation, coercive force measurements. Graphs, diagram, phase diagrams, micrographs. 11 ref. (D general, J general, M21, P16, Fe, Co, Zn)

89-V. Brass Foundry Alloys. Harry St. John. *Foundry*, v. 84, May, 1956, p. 157-159.

Compositions and applications of aluminum bronzes and copper-nickel alloys. Photographs, tables. (T general, E general, Cu)

90-V. Cast Manganese Steel. E. Piwowarsky and H. L. Roes. *Foundry Trade Journal*, v. 100, Apr. 5, 1956, p. 141-149.

Production and metallurgy, including general properties; effect of individual elements, wall thickness, casting temperature; as cast structure; determination of castability and heat treatment. Graphs, photographs, micrographs, tables. 15 ref. (To be continued.) (CI)

91-V. Rem-Cru A-40, A-55 and A-70. *Rem-Cru Titanium Data Sheet*, Feb. 1956, 16 p.

Grades, applications, forms available, physical and mechanical properties, shear, emissivity, creep, fatigue, machinability, corrosion resistance. Tables, graphs. (Ti)

92-V. Beryllium and Zirconium. G. L. Miller. *Times Review of Industry*, v. 10, new ser., Apr. 1956, p. 24-25, 27-28.

Sources, production, fabrication, atomic energy applications, and economic aspects. Tables. 9 ref. (Be, Zr)

93-V. Carbides. V. M. Sheipline and R. J. Runck. Paper from "High-Temperature Technology". John Wiley & Sons. p. 114-130.

Preparation, structure and properties of alkaline-earth metal carbides, carbides of boron and silicon, aluminum and the rare-earth metal carbides, and transition or "hard-metal" carbides. Tables. 122 ref. (SG-h, C-n)

94-V. Borides. C. F. Powell. Paper from "High-Temperature Technology". John Wiley & Sons. p. 131-150.

Preparation and properties of refractory-metal borides. Tables. 61 ref. (SG-h, EG-d)

95-V. Silicides. Ralph Wehrmann. Paper from "High-Temperature Technology". John Wiley & Sons. p. 151-170.

Preparation, properties and applications; metal-silicon systems. Table. 125 ref. (SG-h, Si)

96-V. Nitrides. John M. Blocher, Jr. Paper from "High-Temperature Technology". John Wiley & Sons. p. 171-186.

Preparation and properties of stable, high-melting nitrides. Tables. 41 ref. (SG-h)

97-V. Chromium-Nickel Alloys for High-Temperature Applications. Albert G. Bucklin and Nicholas J. Grant. Paper from "Symposium on Metallic Materials for Service at Temperatures Above 1600° F." American Society for Testing Materials, p. 47-56; disc., p. 56.

Alloys containing 35 to 70% chromium with additions of iron, molybdenum, and columbium, were precision cast and tested in stress-rupture at 1600 to 1800° F. Micrographs, graphs, tables. 5 ref. (Ni)

98-V. (French.) **Ultra-Light Results Obtained in Foundry Alloys Intended for Aeronautical Construction.** Raoul Pradeau. *Métaux, Corrosion-Industries*, v. 31, no. 367, Mar. 1956, p. 140-147.

Investigates problem of making cast magnesium alloy pieces lighter. Development of ultra-light foundry alloys since 1946. Characteristics of magnesium-zirconium foundry alloys. Tables, graphs. 5 ref. (T24, Mg, Zr)

99-V. (French.) **A New Foundry Alloy A-Z5G.** Charles Roinet. *Revue de l'Aluminium*, v. 33, no. 229, Feb. 1956, p. 153-161.

Properties, composition and structure of aluminum-zinc alloy. With only aging or normalization at 180° C., it offers good mechanical, static and dynamic properties and also a remarkable shock resistance. It is easily machined, can be welded, brazed, polished and anodized. Graphs, tables, photographs. (Al)

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ASSISTANT IN WELDING ENGINEERING: One-half time employment. Require B.S. degree in welding, electrical, metallurgical, general or civil engineering, or physics, with strong interest in teaching and research. Knowledge of welding field desirable but not essential. It is assumed that the candidate would be interested in pursuing an advanced degree in welding engineering. Acceptance by the Ohio State University Graduate School is also a condition of employment. Approximately 20 hr. a week will be spent in teaching and research activities. One quarter of course instruction will be given to aid the assistant in performing his teaching assignment. Salary $1800 for nine months. (Out of state fees will be remitted.) Interested persons should forward complete resume of educational and industrial experiences to: Dept. of Welding Engineering, Room 128, Industrial Engineering Bldg., Ohio State University, Columbus 10, Ohio.

RESEARCH ASSISTANT: Opportunity for half-time employment while studying for an advanced degree in metallurgy. Courses and research facilities are available for physics of solids, mechanical metallurgy, physical metallurgy, thermodynamics, kinetics, and X-ray diffraction. Applicants with undergraduate degrees in science or engineering will be considered. Write: Dept. of Metallurgy, The Technological Institute, Northwestern University, Evanston, Ill.

PHYSICAL METALLURGISTS, PHYSICAL CHEMISTS, or CERAMISTS: For development of high-temperature nuclear materials. Specific fields of research include: a) Dispersed phase alloys and cermets for high-temperature use; co-ordination of compatibility, stability, and physical properties for conditions of use. b) Thermochemical investigations relative to development of high-density ceramic bodies; preparation; formulation, sintering rate studies, etc. Opportunities for professional growth through publication and close association with widely differing types of engineers and scientists. Laboratory consists of number of small, closely knit groups developing new materials and components for the nuclear, electronics and power plant fields. Positions require imagination, aptitude, and ability for growth in rapidly expanding field. Research experience and/or graduate study preferred. Send resume in confidence to: Brush Beryllium Co., 4301 Perkins Ave., Cleveland 3, Ohio, c/o Personnel Dept.

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RESEARCH METALLURGIST: With associate status. Capacity for supervising technical and semitechnical personnel. College degree in metallurgy essential. Five to eight years experience in vacuum technology and/or process development. Salary commensurate with experience. Address complete resume, experience, education and salary requirements to: R. D. Crissman, Universal-Cyclops Steel Corp., Bridgeville, Pa.

ONLY THE BEST: We need competent metallurgist who likes people—therefore enjoys success in technical sales; who knows ferrous melting; who likes to guide his own destiny—therefore aspires to management; who is resourceful, imaginative, creative — therefore above average. Knowledge of tool, stainless, superalloys desirable. Home base will be Detroit area. Tell us about yourself and we'll do the same. WalMet, 1999 Guoin, Detroit 7, Mich.

METALLURGICAL ENGINEER: Under guidance of chief metallurgist, to carry out specific or general assignments in materials selection, investigation, or development; to conduct studies and surveys on material properties under conditions of environment, corrosion, nuclear irradiation and unusual operating conditions; to specify materials, welding and joining techniques, heat treatments, etc.; to contact suppliers and company departments on specific assignments and to work with design and analytical engineers. Two to five years in metallurgical or related fields required, plus B.S. degree supplemented by specific metallurgical training. Location: Schenectady, N. Y. Write to: George Y. Taylor, Manager, Employee Services Dept., Alco Products, Inc., Schenectady, N. Y., referring to Position S-117.

METALLURGIST: Company operating large jobbing iron foundry specializing in alloy irons including ductile wants man for metal and sand control. Ground-floor opportunity with sound growing company. Prefer man with foundry background. Box 6-140.

METALLURGIST or METALLURGICAL ENGINEER: With B.S. degree, with or without previous nonferrous wire mill experience, is needed to control manufacturing processes and conduct developmental projects in nonferrous wire department of large company providing attractive wage and additional benefits to aggressive engineer. Box 6-20.

METALLURGICAL ENGINEER: Large, western New York, captive gray iron foundry requires engineering graduate with experience to handle development and process control in the foundry and liaison with those responsible for design and machining of green sand and shell molded castings. Box 6-25.

East

SALES ENGINEER: A firmly established manufacturer of industrial oils and chemicals located on Eastern Seaboard is seeking sales engineer having an engineering background in metallurgy. Preferred age, 26 to 33 years. Box 6-15.

PLANT METALLURGIST: Central Massachusetts manufacturer of well-known hand and electric tools has attractive opening with good future for mechanically-minded metallurgist or mechanical engineer to participate in process development, quality control, product improvement, metallography and testing. Considerable emphasis will be placed on high speed steel, plain carbon and alloy steels, cast iron and heat treatment problems. Prefer young married man, about 25 to 35 years old, who would like to settle down in a small pleasant community. Good personality important. Send resume and salary range. Box 6-30.

MATERIAL ENGINEERS: Major East Coast engineering and manufacturing organization requires metallurgical engineers with approximately ten years diversified experience in one or more of the following areas: light metals, electronic tube materials, ferrous and magnetic alloys. Duties to include providing process and design engineers information on the application and processing of these materials. Applicants should have some experience in preparation of specifications. Excellent company benefits, housing and recreational facilities. Box 6-110.

METALLURGISTS: Several openings available in both plant production and research problems connected with stainless steel manufacturing. B.S. degree in engineering required. Excellent opportunity for young man to establish in large and progressive organization where employee training and development receive careful attention in fulfilling company policy of promotions from within. Box 6-135.

West

METALLURGIST: With five years, or less, experience in nonferrous field, to serve as process and control metallurgist in medium-size company, manufacturing rolled and extruded products. Located in Southern California out of Los Angeles area. Box 6-35.

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Company engaged in basic process and pyrometallurgy requires several men in Production, Development and Quality Control who have some experience in one or more of the following: Smelting and Refining, Steelmaking, or Electric Furnace Operation. Excellent opportunities for qualified men. Hospitalization, insurance and pension plan provided by the Company. Plants located Midwest, North and South. All replies strictly confidential. Submit detailed resume.

Box 6-130, Metals Review

POSITIONS WANTED

METALLURGIST: Age 42. Twenty years experience in production and heat treat control, including heat treatment of alloy and carbon steels, gas carburizing, welding, shot peening, materials specification, all phases of laboratory work. Presently employed as chief metallurgist. Desires similar position in smaller organization, Central, West or South. No degree. Box 6-40.

MATERIALS ENGINEER: Proficient in metallurgy, mechanical engineering and stress analysis. Background in high-temperature materials, turbine design, internal combustion engines and Ordnance activities, with supervisory experience. Desires challenging and responsible position in engineering or applied research and development. B.S. degree with graduate study, age 32, family. Minimum salary $10,000. Box 6-45.

METALLURGICAL ENGINEER: Age 24, married, no children, B.S. degree, presently serving two-year tour in U. S. Army which will be completed by Sept. 1. Two years experience in Army as foundry engineer and metallurgist at well-known government laboratory. Desires work in nonferrous foundry as production or development engineer. Minimum salary $6500. Box 6-50.

DIRECTOR - METALLURGIST - CHEMIST: Unusual research combination, B.S. in chemistry, M.A. in international relations (night school, 60 credits towards Ph.D.), thesis on international scientific organizations; diplomas in metallurgy and electrical engineering; also diplomas in bombsight and automatic pilot maintenance, photo-interpretation and photogrammetry, personnel management, atomic weapons. Three years in electronics, servomechanisms, mechanics; 1½ years analytical chemist; 7 years testing and metallurgical investigations in steel industry; 7 years technical intelligence specialist (2 years supervisory), ferrous, nonferrous metals, equipment, armament, special weapons, etc. Extensive research in Library of Congress; numerous contacts in Washington agencies; widely traveled in Europe and U.S. $9000 minimum with advancement potential. Box 6-55.

CHIEF METALLURGIST: B.S. degree in chemical engineering, age 41, family. Four years experience as Naval architect in welded ship construction, 4 years in quality control, trouble shooting, and process development in small hand tool company, 2 years as process control metallurgist in large aircraft company. Presently in charge of research and development group in large aircraft company. Desires challenging, responsible position with progressive company. Box 6-60.

TOP-FLIGHT SUPERVISOR: Fully qualified and experienced as technical director (metallurgical and chemical), executive assistant, plant superintendent. Fifteen years proven ability in metals field, including ferrous, nonferrous, deep drawing, heat treating, plating. Speaking and writing experience, B.S. and M.B.A. degrees, age 38. Minimum $12,000. Box 6-65.

METALLURGICAL EXECUTIVE: With 22 years automotive, aircraft engine, and aircraft chief metallurgist and management experience. Unique background and record in materials engineering, manufacturing, application and process research and development, and administration. Fully qualified to direct all aspects ferrous and nonferrous activity. Interested only in top-level position. Box 6-70.

METALS TECHNOLOGIST: Age 41. Theoretical and applied background in nonferrous alloy development, some ferrous heat treating. Chemical analysis, physical testing, metallography. Controlled base and precious metals electroplating, electropolishing and general metal finishing. Past association with manufacturers in precious metals refining, brazing alloys, jewelry, business office machines, power electronic tubes. Box 6-75.

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SALES or PRODUCTION MANAGER: Age 33, veteran, married. Mechanical engineering degree plus extensive graduate study in metallurgical subjects. Three years as alloy steel metallurgist in sales with prominent warehouse, 5 years with producing mill and fabricator of magnesium and aluminum alloy products as production manager, sales engineer, district sales manager and plant manager. Box 6-85.

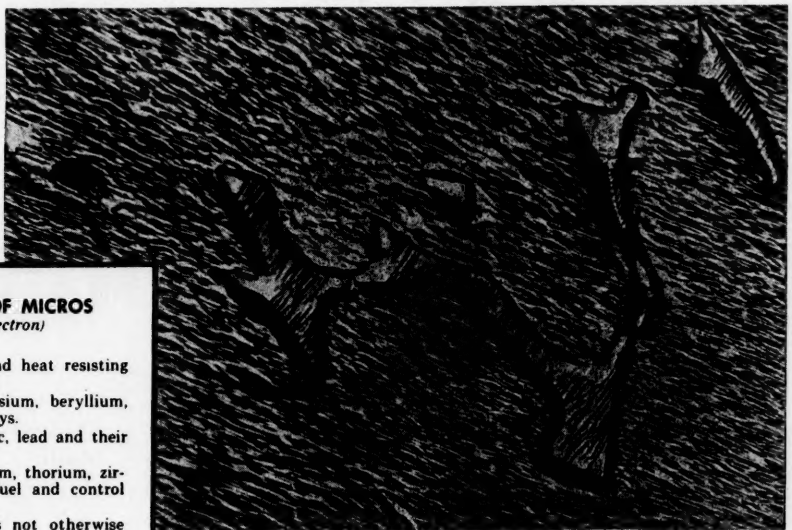
METALLURGIST: B.S. degree in chemistry, age 36. Ten years experience in physical testing, metallography and heat treating of ferrous and nonferrous metals related to aircraft and aircraft engines, including toolsteels and high-temperature alloys, 2 years in carburizing and nitriding processes, 4 years in chemical analysis of ferrous and nonferrous metals and process solutions. X-ray analysis pertaining to chemistry and structures, supervisory experience, extensive report writing and special assignments without direct supervision. Titanium and titanium alloy experience. Box 6-90.

METALLURGICAL ENGINEER: B.S. degree, age 34. Thirteen years diversified experience in research and metal processing fields including administrative positions. Familiar with over-all management problems such as production schedules, quality control, inspection procedures, engineering, specifications, purchasing, etc. Desires position in research or manufacturing. Middlewest preferred. Box 6-95.

METALLURGICAL ENGINEER: Canadian, B.A. from Laval, M.S. from McGill, 1952. Two years experience in aircraft heat treatment, metallography, physical metallurgy, welding and soldering of electroplating and photomicrography. Experience as chief chemist and metallurgist. Wishes to locate as metallurgist in U.S. Box 6-100.

METALLURGICAL ENGINEER: B.S. degree, age 28, family. Six years experience. Melting experience including vacuum, atmosphere, air, induction, arc, resistance, electric arc steel. Produced all types of alloys for research and development including high-temperature, refractory and fissionable. Fabrication experience including inert atmosphere welding and fabrication of reactive materials. Desires position in development or process engineering. Box 6-105.

11th Metallographic Exhibit



CLASSIFICATION OF MICROS
(Optical and Electron)

Class 1. Irons and steels.
Class 2. Stainless steels and heat resisting alloys.
Class 3. Aluminum, magnesium, beryllium, titanium and their alloys.
Class 4. Copper, nickel, zinc, lead and their alloys.
Class 5. Uranium, plutonium, thorium, zirconium and reactor fuel and control elements.
Class 6. Metals and alloys not otherwise classified.
Class 7. Series showing transitions or changes during processing.
Class 8. Welds and other joining methods.
Class 9. Surface coatings and surface phenomena.
Class 10. Results by unconventional techniques (other than electron micrographs)
Class 11. Slags, inclusions, refractories, cermets and aggregates
Class 12. Color prints in any of the above classes (no transparencies accepted)

Entries are invited in the 11th ASM Metallographic Exhibit, to be held at the National Metal Exposition in Cleveland, Oct. 6 through 12, 1956.

RULES FOR ENTRANTS

Work which has appeared in previous metallographic exhibits held by the American Society for Metals is unacceptable. Photographic prints should be mounted on stiff cardboard; maximum dimensions 14 by 18 in. (35 by 45 cm.) Heavy, solid frames are unacceptable. Entries should carry a label on the *face* of the mount giving:

Classification of entry
Material, etchant, magnification
Any special information as desired

The name, company affiliation and postal address of the exhibitor should be placed on the *back* of the mount.

Entrants living outside the U. S. A. should send their micrographs by first-class letter mail endorsed "Photo for Exhibition—May be opened for customs inspection".

Exhibits must be delivered before Oct. 1, 1956, either by prepaid express, registered parcel post or first-class letter mail, addressed to:

ASM Metallographic Exhibit
7301 Euclid Ave.
Cleveland 3, Ohio

AWARDS AND OTHER INFORMATION

A committee of judges will be appointed by the Metal Congress management which will award a First Prize (a medal and blue ribbon) to the best in each classification. Honorable Mentions will also be awarded (with appropriate medals) to other photographs which, in the opinion of the judges, closely approach the winner in excellence. A Grand Prize, in the form of an engrossed certificate and a money award of $100, will also be awarded the exhibitor whose work is judged best in the show, and his exhibit shall become the property of the American Society for Metals for preservation and display in the Society's national headquarters in Cleveland.

All photographs may be retained by the Society for one year and placed in a traveling exhibit to the various Chapters. They will be returned to the owners in May 1957 if so desired.

38TH NATIONAL METAL CONGRESS AND EXPOSITION

CLEVELAND, OHIO **OCTOBER 6 to 12, 1956**

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